

FINAL REPORT

September 30, 2019

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2018 Georgia Smart Communities  
Challenge

Chamblee –  
Shared Autonomous Vehicle Study





# Vision

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A team of employees from the Centers for Disease Control hop on a shared autonomous vehicle (SAV) to grab lunch in downtown Chamblee to celebrate a birthday. A teen summons an on demand SAV to play ball at Keswick Park, instead of being shuttled by parents. A resident from downtown Atlanta hops off the train and takes an SAV to work at Third Rail Studios.



# Project Overview

- How can we design the user experience to ensure this project is more than a novelty? It should be a true mobility solution.
- What utilitarian decisions need to be made to be a leader in this technology and pilot an AV shuttle in Chamblee?

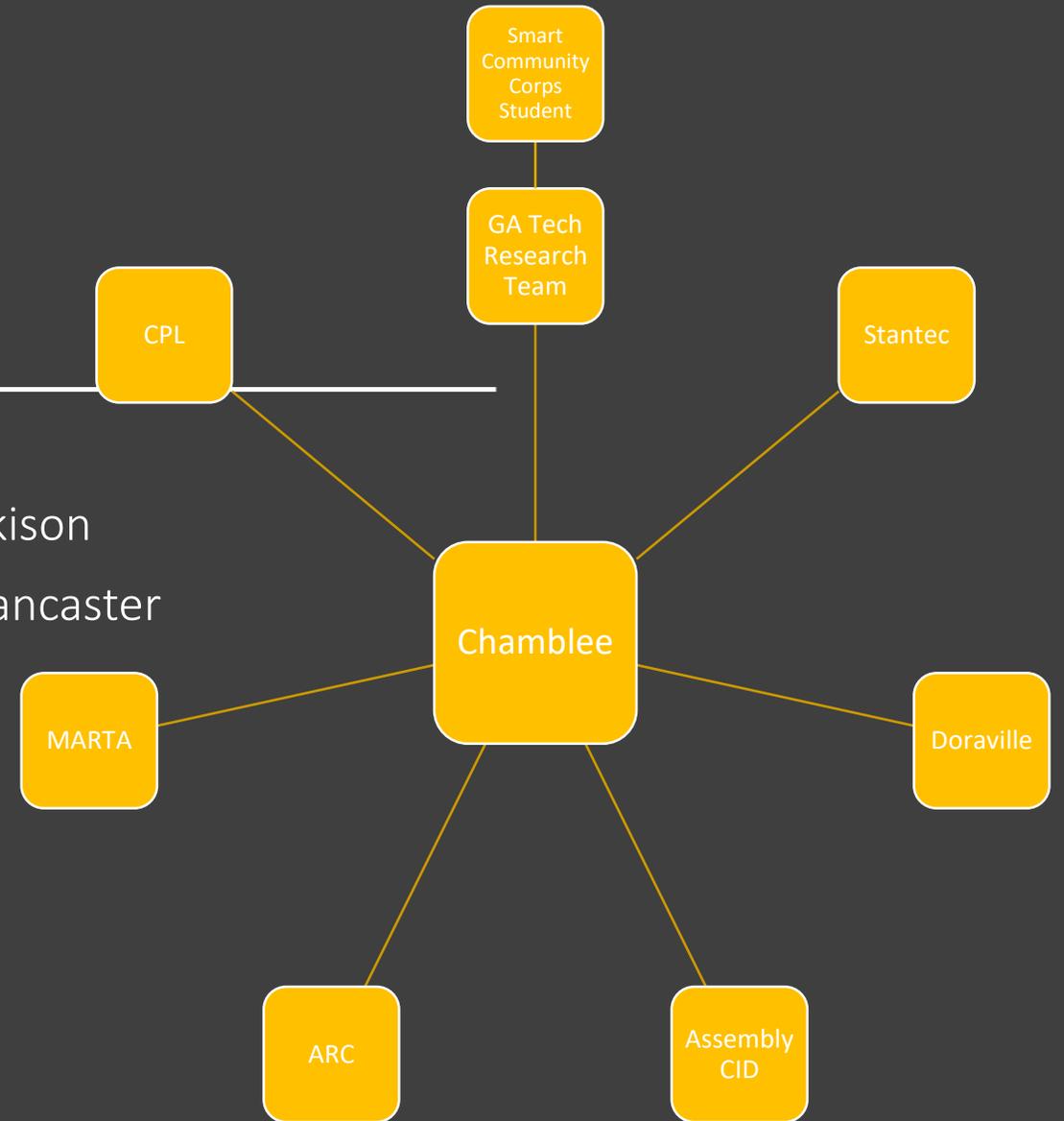
## Context Map





# Project Team

- Chamblee – Rebecca Keefer, Andrew Russell, Matt Dickison
- GA Tech Research Team – Ellen Dunham-Jones, Zach Lancaster
- Smart Community Corps – Rey Angeles
- Assembly CID – Eric Pinckney, Matt Samuelson
- Stantec – Craig Lewis, Michelle Orfield, Joel Mann
- Doraville – Luke Howe





# Project Deliverables

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- **Operations Plan**
  - Detailed route planning, scheduling, logistics, and cost estimates to prepare the City for selection of operator for deployment.
- **Best Practices Manual**
  - Anticipate a series of design guidelines for local governments to explore and eventually serve as a turnkey solution for autonomous vehicles and shuttles in a community; and
  - Report to other local governments wishing to follow our path, as well as identify any regulatory barriers toward local government implementation at the local, state, and federal levels.



# Project Motivations and Goals

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- Interest in Smart Mobility
- Desire to be a leader and trail blazer in the intelligent infrastructure systems field
- Commitment to sound land use/transportation policies that support infrastructure for autonomous shuttles
- Development of a strategy for economic development
- Support equity for households with no car ownership to provide access to services



# Initial Investments

- Feasibility Study adopted in 2018:
  - Description of technology
  - Chamblee analysis
  - Cost estimates
  - Route alternatives – selected Peachtree Road
  - Recommendations
  - Next steps
- Peachtree Road Streetscape and Rail Trail Plan adopted in 2018:
  - Road diet
  - Safety and operational improvements
  - Construction to be complete Summer 2020





# Comparative Analysis

City Civic Complex

PDK Airport

Peachtree Station

Chamblee Plaza

Keswick Park

Third Rail/ Assembly

CDC/ IRS

Number of residents along route



Number of job along route



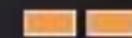
Number of trips per hour with 2 vehicles



Compatibility with low speed shuttle



Increase in transit service coverage





Manufacturers and Self-Driving Shuttles in the process of testing and launching pilot programs.



**Easy Mile**  
EZ10



**Local Motors**  
Olli



**Navya**  
Arma

**Self-Driving Shuttle Specifics**



**25 mph**  
top speed

**8-16 people**  
maximum capacity

**3-10 hours**  
amount of time on a  
single battery charge

**16'x7'x9'**  
typical size

**Self-Driving Shuttle and Standard Bus Comparison**



16 feet



40 feet

# Shuttle Details

**Notable Features:**

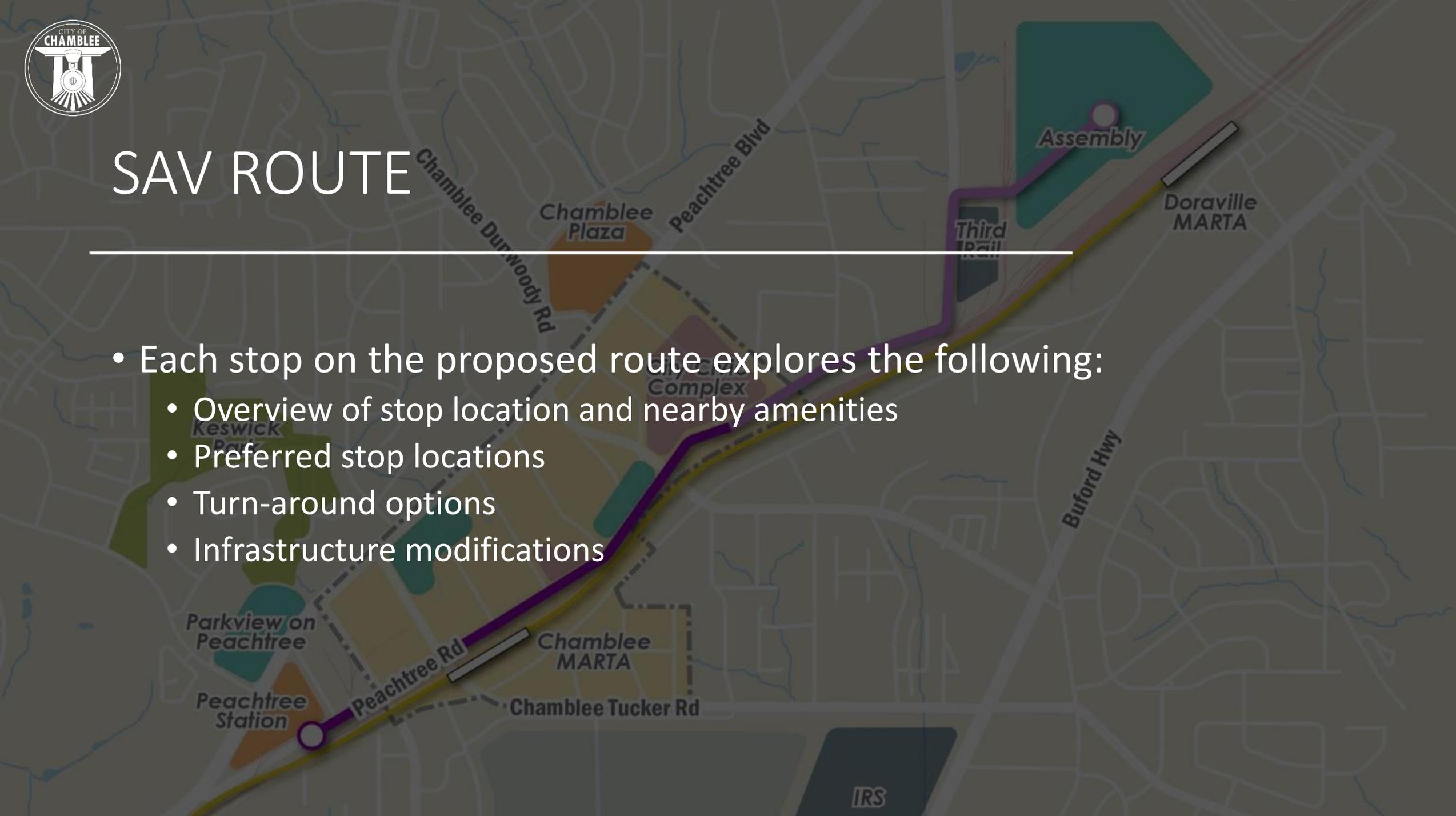
- » Tight enough of a turning radius (13-15 feet) to drive on existing streets
- » Operates in both directions, eliminates the need to turn around
- » Works with a mobile app for on demand calls and real time monitoring
- » Wheelchair accessible and working to offer more accessibility features and compliance with Americans with Disabilities Act (ADA) regulations
- » Redundant breaking mechanisms
- » Emergency stop button on-board
- » Direct telecom connection to central command hub for passengers



# SAV ROUTE

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- Each stop on the proposed route explores the following:
  - Overview of stop location and nearby amenities
  - Preferred stop locations
  - Turn-around options
  - Infrastructure modifications





Mercy Care

MARTA (Chamblee)

Chamblee-Dunwoody

5 Broad

6 Third Rail (Optional Extension)

7 Assembly Yards (Optional Extension)

Keswick Park

Parkview on Peachtree

Peachtree Station

Chamblee Plaza

City Civic Complex

Chamblee MARTA

Chamblee Tucker Rd

Peachtree Blvd

Third Rail

Assembly

Doraville MARTA

900'

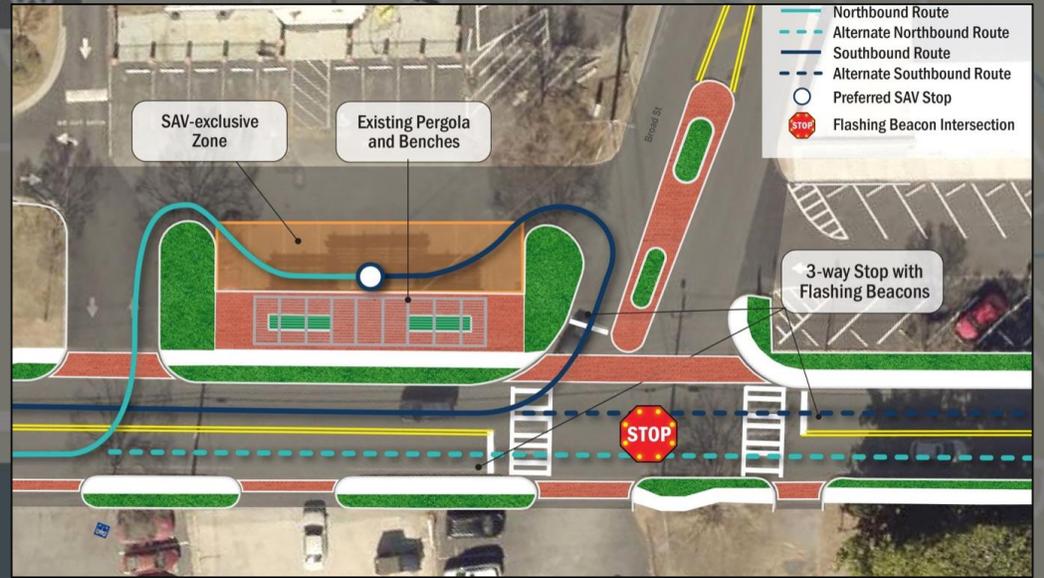
4700'

1350'

1350'

2075'

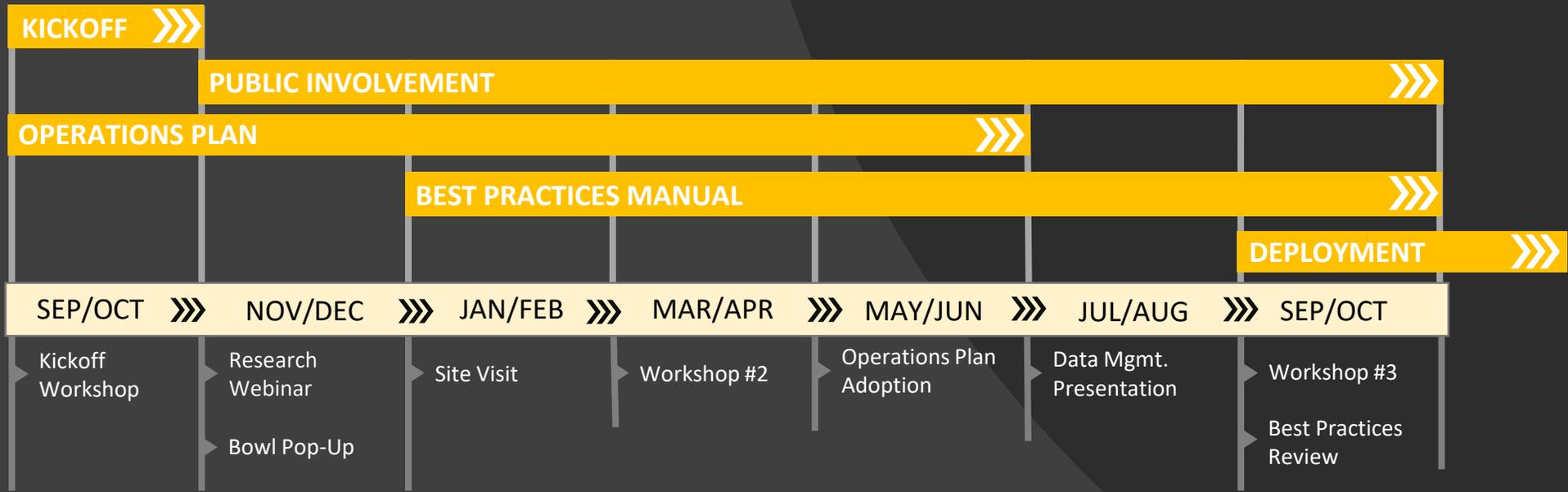
1045'



IRS



# Schedule





# Public Involvement



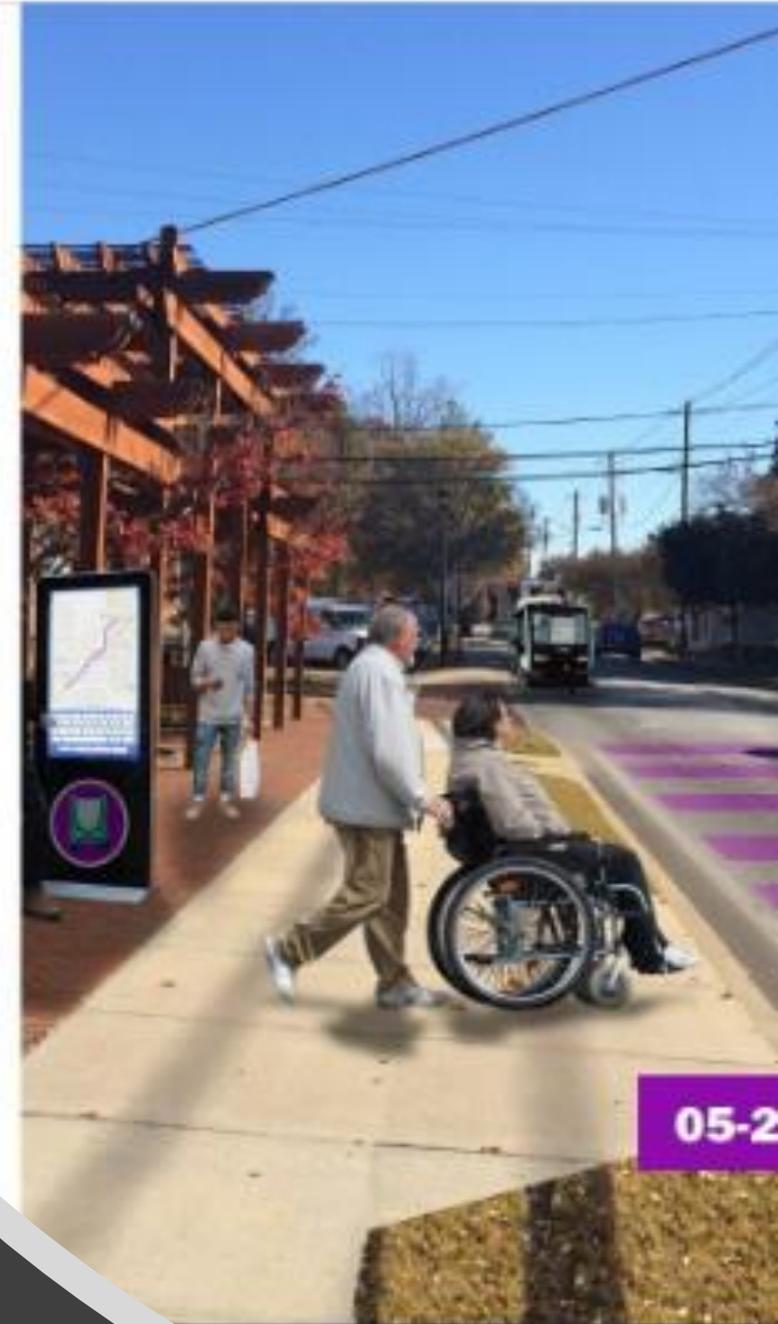


# Operations Plan

- Adopted May 2019
- Project description and schedule
- Charging/Storage/Maintenance plan
- Routing and signage/signalization criteria
- Technology provider(s) and operations team and responsibilities
- Use case scenarios
- Testing and evaluation plan
- Funding and procurement of system/services
- Risk assessment and mitigation strategies
- Emergency response plan
- Licensing requirements
- Cost estimates

**CHAMBLEE**  
Dedicated Shuttle  
Design Plan

Georgia





# Operations

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Peachtree Station - Assembly  
Length = 2.2 miles



10 hour service day / 7  
days / week



Single SAV (no spare)  
= 15-minute headway



# Deployment Costs

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## Infrastructure Improvements

\$75,000 - \$100,000

- Connected infrastructure
- Flashing beacon stop signs
- Benches
- Sidewalk connectivity
- Lane painting / signage



## Capital Expenditures

\$10,000 - \$35,000 (monthly lease)  
\$250,000 - \$425,000 (own)

- Vehicle
- Start up training & programming



## Annual Operating Costs

\$250,000 - \$350,000

- Software licensing
- Insurance
- Maintenance
- Onboard attendant
- Program management



LANE  
SMART  
CHAMBLEE

ANTIQUE  
MARKET





# Press

## Initiative on Cities and Autonomous Vehicles

World / Americas / United States

### Chamblee, US is preparing

Policy and Planning Priorities:

Land Use and Transit Planning, Pilot Zone Identification

In 2018, Chamblee was the first city in the world to start a project to study the possibility of self-driving shuttles. The project includes an internal study of the city's infrastructure and a public consultation process. The city is currently in the process of identifying pilot zones for autonomous vehicle shuttles.

3/24/2019

Shuttles without drivers could be rolling into metro Atlanta city

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### Chamblee eyes launching autonomous vehicle shuttle routes (Video)

Small Share Print Order Reprints



3/24/2019

Could Self-Driving Shuttles be Coming to Chamblee? - W...

COMMUTING IN METRO ATLANTA Share

### Could Self-Driving Shuttles be Coming to Chamblee?

POSTED ON AUGUST 7, 2018

### GA: What would a self-driving shuttle on Peachtree Road look like?

Shuttles without a driver behind the wheel could be rolling onto a busy DeKalb County corridor.

J.D. CAPELOUTO MARCH 15, 2019

THE ATLANTA JOURNAL-CONSTITUTION

Share Tweet

Imagine tapping an app on your phone and just a few minutes later, up to take you wherever you want to go at an affordable price.

Oh right. You can already do that.

Now imagine that the vehicle pulling up to your curb has no driver. The Chamblee, along with several partners, is preparing for just that.

Chamblee is one of four cities across Georgia to win a grant from Geo Smart Communities Challenge. Chamblee will study how shared, autonomous vehicles – think a self-driving Uber or Lyft – and other autonomous and connected technologies may shape the future of the North DeKalb County.

Written by JIM JAQUISH

Share on Facebook Twitter LinkedIn Reddit

<https://whatnextatl.org/could-self-driving-shuttles-be-coming-to-chamblee/>



### Would metro commuters ride self-driving shuttle?

<https://www.ajc.com/news/atlanta/would-metro-commuters-ride-self-driving-shuttle/5DmstfC>

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AMC Theatres

WEBSITE DIRECTIONS

### Driverless shuttles could be coming to DeKalb County city

By: Steve Gehlbach

Updated: Mar 18, 2019 - 8:47 PM

DRIVERLESS SHUTTLES

Craig Lucie @CraigLucie

6:55 5P

WABV.COM

wheel could be rolling onto a

to vote on a resolution to apply

at would fund a set of self-

tles, which would take

nectivity seemed intriguing,

d really be on the leading

and is chosen, the city

d he expects the



# Process Improvement, Data, and Automation

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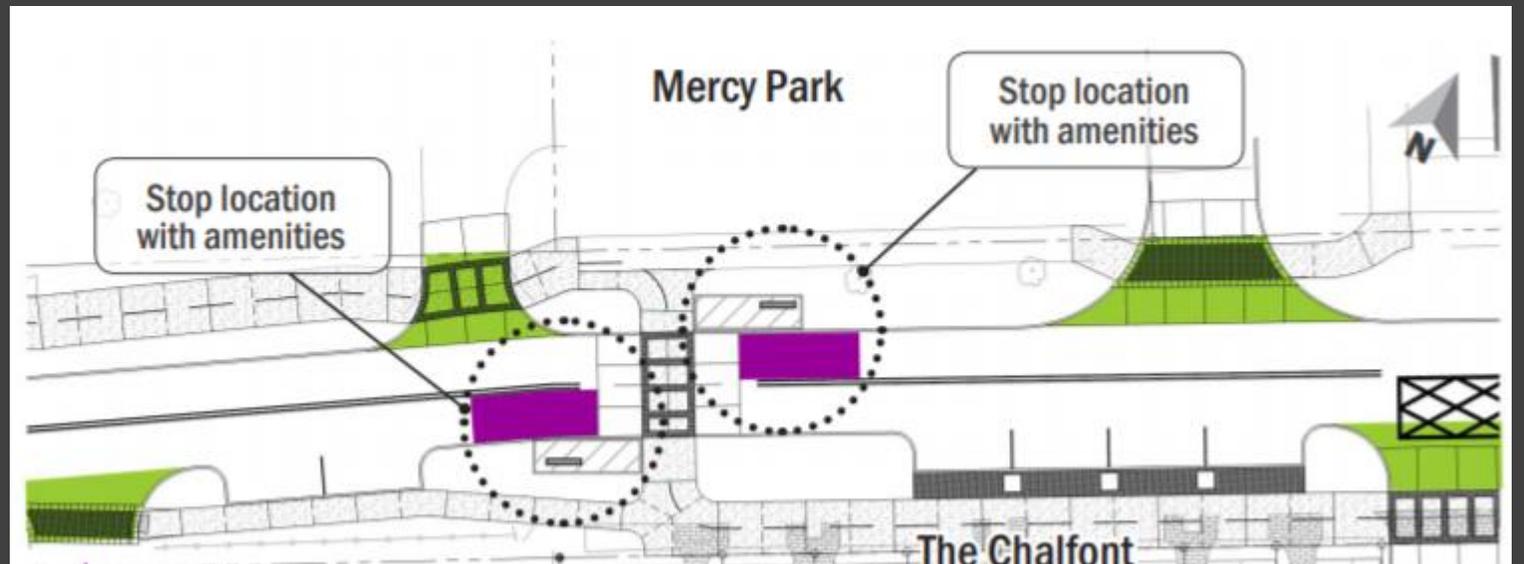
- Refined shuttle stops developed – phase A and phase B priority routes have been identified based on more detailed information about the available infrastructure.
  - Phase A – Core Route
    - The proposed core automated shuttle route is 2.2 miles (roundtrip) with 5 stops, including a connection to the MARTA Gold Line and Bus Routes 103, 132, 825, and 408 at MARTA’s Chamblee Station. Five proposed stops: Peachtree Station, Mercy Park, MARTA (Chamblee), Chamblee Dunwoody Way, and Broad Street comprise the core route. The core route serves as a vital first/last-mile connection for those that live, work, shop, and dine in the developments along Peachtree Road. The core route is also very conducive to safe automated shuttle operations, with an array of traffic calming measures and multi-modal accommodations.
  - Phase B – Extended Route
    - The extended route is 4.2 miles (roundtrip) and adds stops at Third Rail Studios and Assembly Yards. The stops at Third Rail Studios and Assembly Yards connect these employment and future residential areas with businesses and services along Peachtree Road. To safely serve these employment centers, efforts to calm traffic and reduce driveway access are required. Overall, the route requires only modest infrastructure improvements for implementation and creates meaningful connections between destinations.



# Recommendations

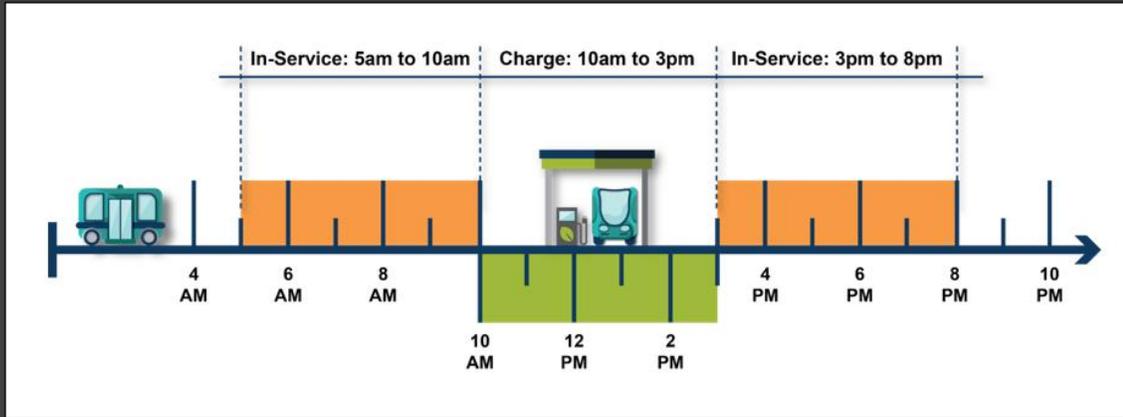
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- Minor infrastructure modifications
- Stop modifications
- Turn-around locations
- Charging requirements
- Service profile
- Cost estimates

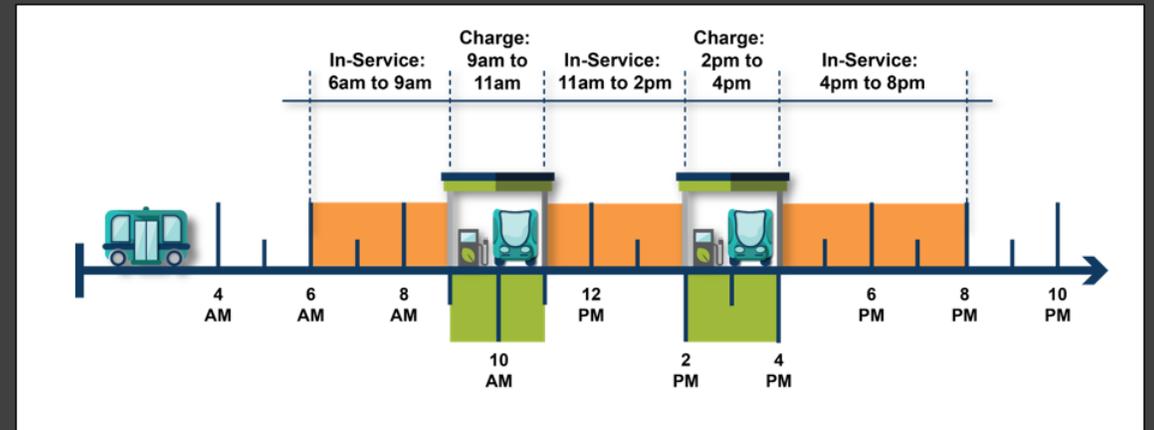
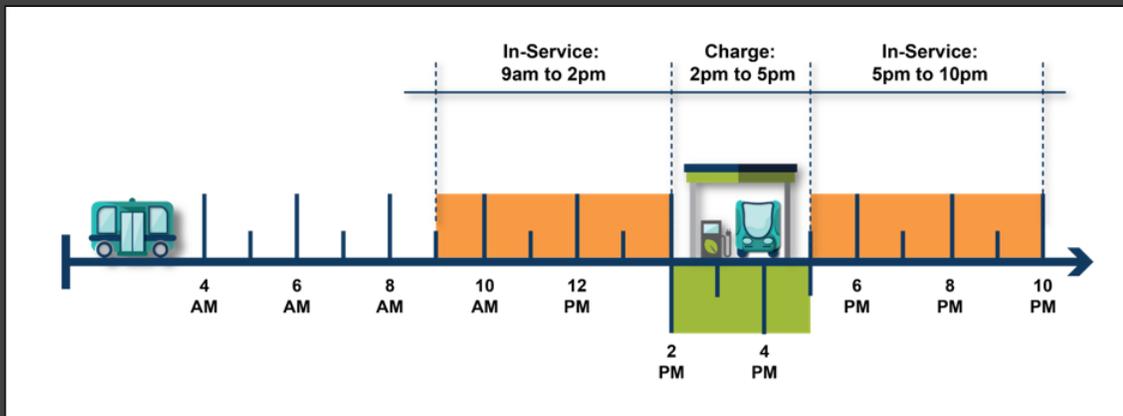




# Service Profile

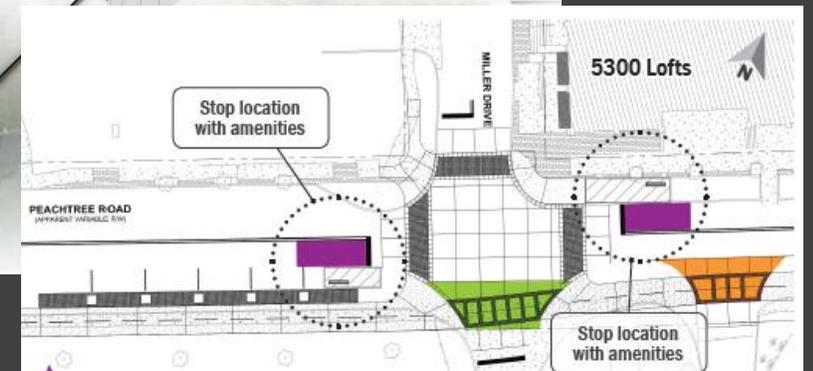
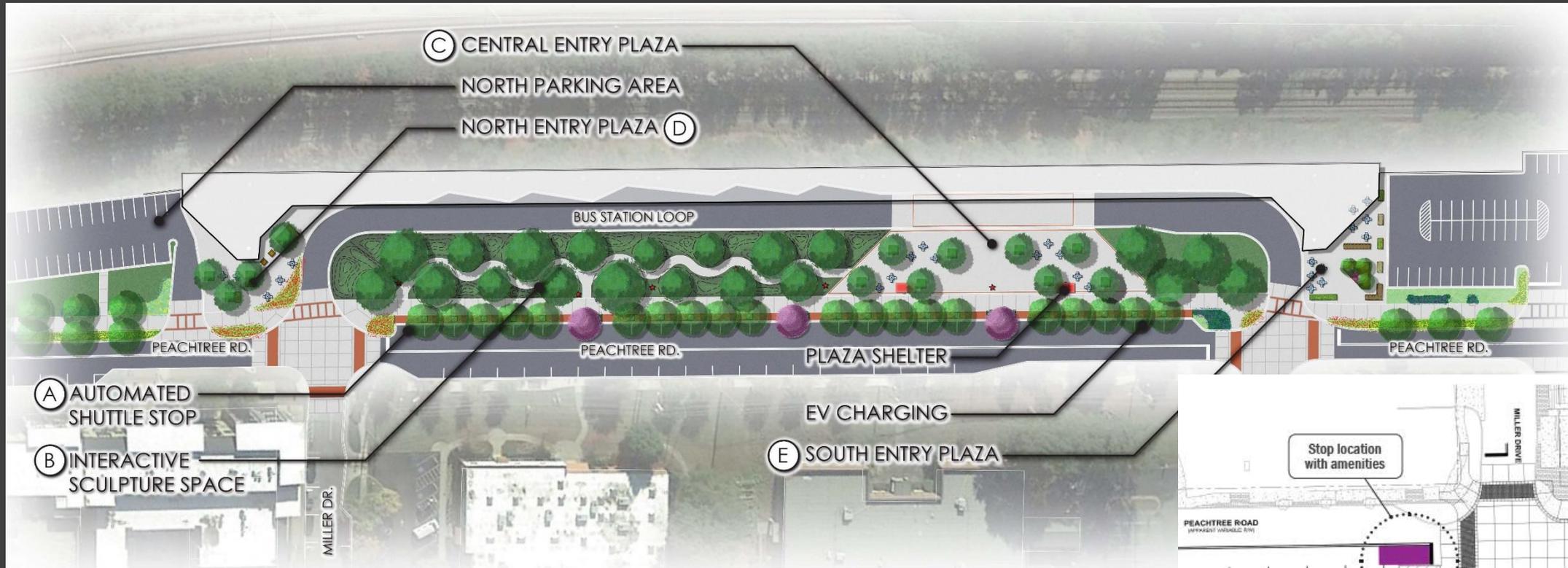


Example Northbound Time Table - Commuter Shuttle Service				
Peachtree Station	Mercy Park	MARTA	Chamblee - Dunwoody	Broad
5:00 AM	5:01 AM	5:03 AM	5:05 AM	5:07 AM
5:14 AM	5:16 AM	5:18 AM	5:20 AM	5:22 AM
5:29 AM	5:31 AM	5:33 AM	5:35 AM	5:37 AM
5:44 AM	5:46 AM	5:48 AM	5:50 AM	5:52 AM





# Future Investments





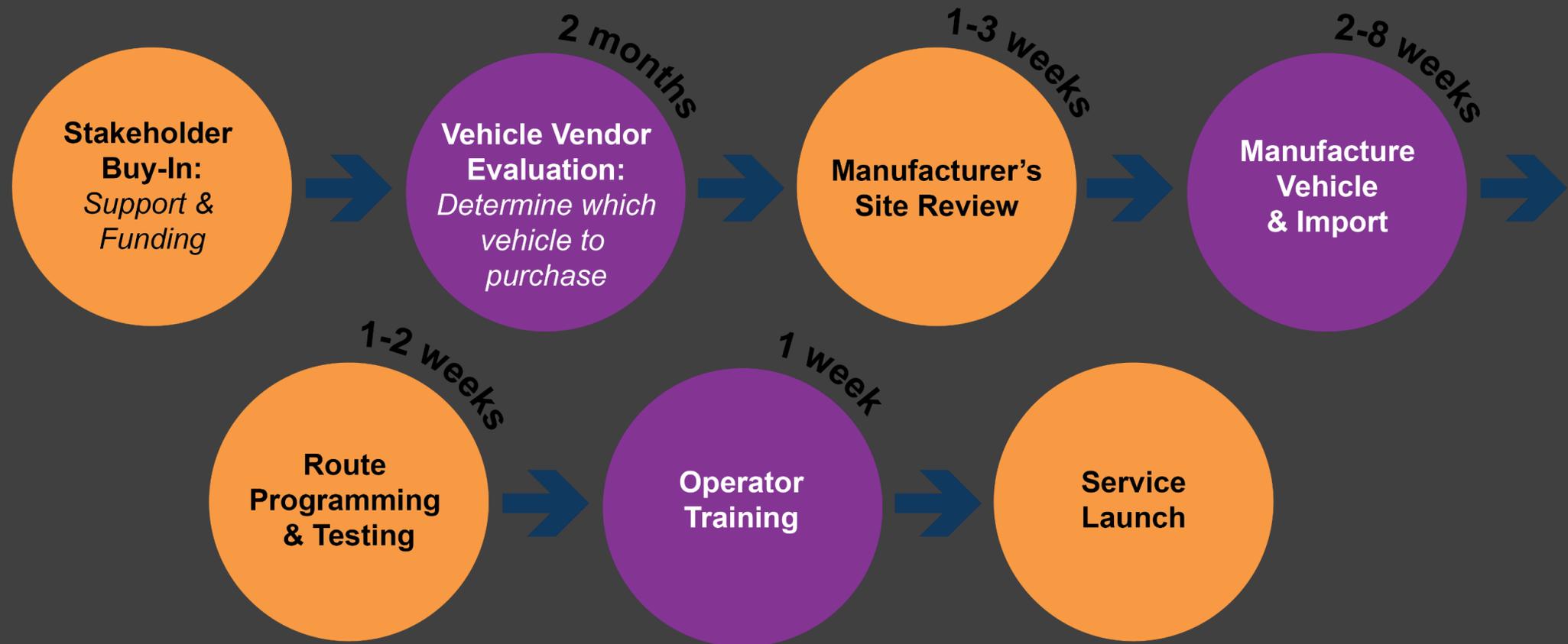
marta







# Project Actions





Purchase Option									
		Quantity			Unit	Unit Price	Total		
		Year 1 Core Route	Year 1 Extension	Year 2			Year 1 Core Route	Year 1 Extension	Year 2
<b>Infrastructure</b>									
<b>Required Infrastructure</b>									
	Connected Traffic Signal	1			EA	\$10,000	\$10,000		
	Concrete Landing Pad (4" Thick)	44.4	17.8		SY	\$42	\$1,867	\$747	
	Secure Storage	1			EA	\$50,000	\$50,000		
<b>Recommended Infrastructure</b>									
	Advisory Signs	14	9		EA	\$500	\$7,000	\$4,500	
	Painting - Lane Symbol	12	4		EA	\$150	\$1,800	\$600	
	Bench	5	2		EA	\$1,500	\$7,500	\$3,000	
	Trash Can	5	2		EA	\$2,000	\$10,000	\$4,000	
<b>Optional Infrastructure</b>									
	Flashing Beacons	6	3		EA	\$5,000	\$30,000	\$15,000	
	Solar Panel Array	10,000			WATT	\$2.50	\$25,000		
	Painting - Lane Striping		1,000		LF	\$7.00		\$7,000	
	Contingency						\$25,000	\$6,000	
<b><i>SUBTOTAL</i></b>							<b><i>\$168,167</i></b>	<b><i>\$40,847</i></b>	<b><i>\$0</i></b>
<b>Fleet</b>									
	Automated Shuttle Purchase	1			EA	\$350,000	\$350,000		
<b><i>SUBTOTAL</i></b>							<b><i>\$350,000</i></b>	<b><i>\$0</i></b>	<b><i>\$0</i></b>
<b>Operational</b>									
	Start-Up Costs	1			EA	\$75,000	\$75,000		
	Operations	1		1	YEAR	\$300,000	\$300,000		\$300,000
	Software Licensing	1		1	YEAR	\$40,000	\$40,000		\$40,000
	Insurance	1		1	YEAR	\$10,000	\$10,000		\$10,000
	Electricity	1		1	YEAR	\$1,000	\$1,000		\$1,000
	Maintenance	1		1	YEAR	\$50,000	\$50,000		\$50,000
<b><i>SUBTOTAL</i></b>							<b><i>\$476,000</i></b>	<b><i>\$0</i></b>	<b><i>\$401,000</i></b>
<b>TOTAL</b>							<b>\$994,167</b>	<b>\$40,847</b>	<b>\$401,000</b>
<b>GRAND TOTAL</b>							<b>\$1,436,014</b>		



Lease Option									
		Quantity			Unit	Unit Price	Total		
		Year 1 Core Route	Year 1 Extension	Year 2			Year 1 Core Route	Year 1 Extension	Year 2
<b>Infrastructure</b>									
<b>Required Infrastructure</b>									
	Connected Traffic Signal	1			EA	\$10,000	\$10,000		
	Concrete Landing Pad (4" Thick)	44.4	17.8		SY	\$42	\$1,867	\$747	
	Secure Storage	1			EA	\$50,000	\$50,000		
<b>Recommended Infrastructure</b>									
	Advisory Signs	14	9		EA	\$500	\$7,000	\$4,500	
	Painting - Lane Symbol	12	4		EA	\$150	\$1,800	\$600	
	Bench	5	2		EA	\$1,500	\$7,500	\$3,000	
	Trash Can	5	2		EA	\$2,000	\$10,000	\$4,000	
<b>Optional Infrastructure</b>									
	Flashing Beacons	6	3		EA	\$5,000	\$30,000	\$15,000	
	Solar Panel Array	10,000			WATT	\$2.50	\$25,000		
	Painting - Lane Striping		1,000		LF	\$7.00		\$7,000	
	Contingency						\$25,000	\$6,000	
<b>SUBTOTAL</b>							<b>\$168,167</b>	<b>\$40,847</b>	<b>\$0</b>
<b>Fleet</b>									
	Automated Shuttle Lease - 3 year	1			YEAR	\$180,000	\$180,000		\$180,000
<b>SUBTOTAL</b>							<b>\$180,000</b>	<b>\$0</b>	<b>\$180,000</b>
<b>Operational</b>									
	Start-Up Costs	1			EA	\$75,000	\$75,000		
	Operations	1			YEAR	\$300,000	\$300,000		\$300,000
	Electricity	1			YEAR	\$1,000	\$1,000		\$1,000
<b>SUBTOTAL</b>							<b>\$376,000</b>	<b>\$0</b>	<b>\$301,000</b>
<b>TOTAL</b>							<b>\$724,167</b>	<b>\$40,847</b>	<b>\$481,000</b>
<b>GRAND TOTAL</b>							<b>\$1,246,014</b>		



# Opportunities

- SPLOST Funding (2020 or 2021)
- Grants:
  - USDOT Driverless Shuttle Demonstration Grant – unsuccessful
  - ATL call for projects – favorable project rating
  - ARC Transportation Systems Management & Operations (TSMO) – favorable project rating (see below)
  - Olli Challenge – unsuccessful

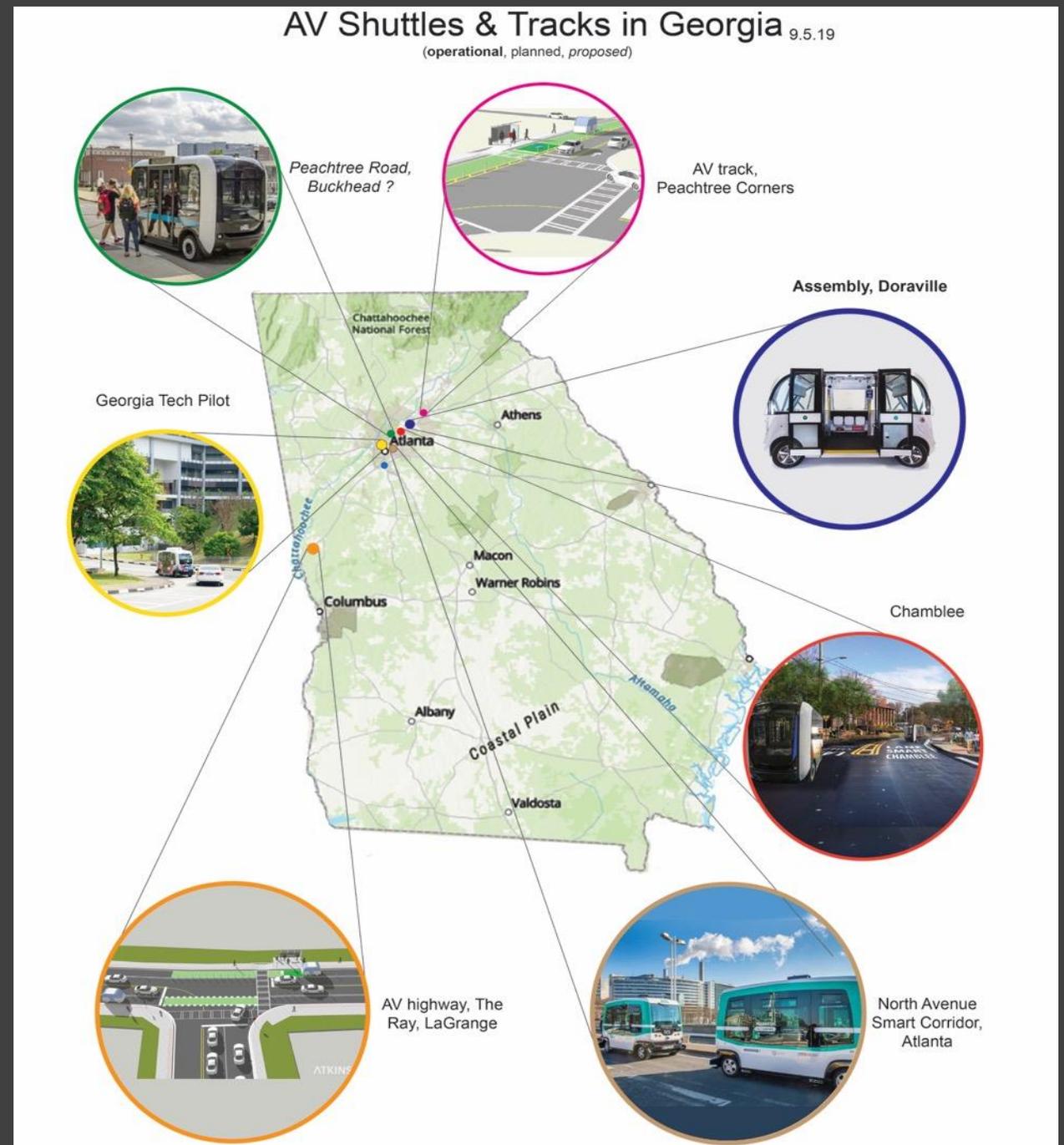
PILOT PROJECT TITLE	SUBMITTING ORGANIZATION	PILOT PROJECT DESCRIPTION	PROJECT TYPE	SPECIFIC LOCATION	CHAMPION	CONCEPTUALITY	COMPLEXITY	RELATIVE COST	GOALS	REGIONAL IMPACT
Virginia Avenue Smart Corridor DSRC v. Cellular V2X Pilot	Aerotropolis Atlanta CIDs	Conduct a DSRC v. C-V2X (4G LTE and 5G) pilot study along the Virginia Avenue Smart Corridor as a follow-up of the Virginia Avenue Smart Corridor Study	Vehicular Mobility			1		\$\$		
Emergency Vehicle Preemption Technology	Temple	Use connected vehicle preemption technology to provide green lights at traffic intersections to allow safe passage of the emergency vehicle while bringing all public vehicles safely to a halt. Specifically, this is a concern in rural areas where speeds at signalized intersections are high	Vehicular Mobility			1		\$\$		
Wrong Way Detection	MH Corbin, LLC	Utilize existing radar and/or camera infrastructure (ConnectITS) to detect, verify, and alert in real-time wrong-way driving vehicles and sends information to the TMC/other agencies	Vehicular Mobility			1		\$		
Smart Corridor Study	Sandy Springs	Conduct a smart corridor study on Mount Vernon Hwy corridor between Sandy Springs MARTA Station and Sandy Springs City Center	Vehicular Mobility			2		\$		
Intelligent Left Turn Signals	Temple	Install Intelligent Left Turn's where there are unprotected left turns with high-speed dual lane traffic	Vehicular Mobility			4		\$\$		
Emergency Vehicle Response Time	City of Sandy Springs	Leverage the City of Sandy Springs' investment in emergency vehicle preemption at traffic signals by coordinating with existing CAD systems' routing algorithms (uses GPS and signal geofencing data to make real-time adjustments to predetermined dispatch routes)	Vehicular Mobility			4		\$\$		
Principal Arterial Speed Limits	City of Atlanta	Implement variable speed limits on principal arterials during AM and PM peak hours to assist with progression	Vehicular Mobility			5		\$\$\$		
Shared Autonomous Shuttle Demonstration	City of Chamblee	Test the use of a sensor-enabled Autonomous Driving System (ADS) over a 2-year performance period to refine and test routes and operations	Vehicular Mobility			5		\$		



## Autonomous Shuttle Buses

### The promise of automated, electrified, shared mobility:

- Increased frequency, lower cost transit service
- Safer, more livable streets and redeveloped parking lots
- Increased social capital
- In GA: 2 test tracks, 1 operating, 3 planned, 1 proposed





## The hurdles of implementing AV shuttles:

- Approx. 60 in or recently in operation today, none living up to the promises yet
- Technical concerns
- Cost, regulatory, and job loss concerns
- Multi-modal competition



**Research Question:** How can the user experience of getting to, waiting for, and riding on be improved so AV shuttles live up to their promise?

### Research Deliverable:

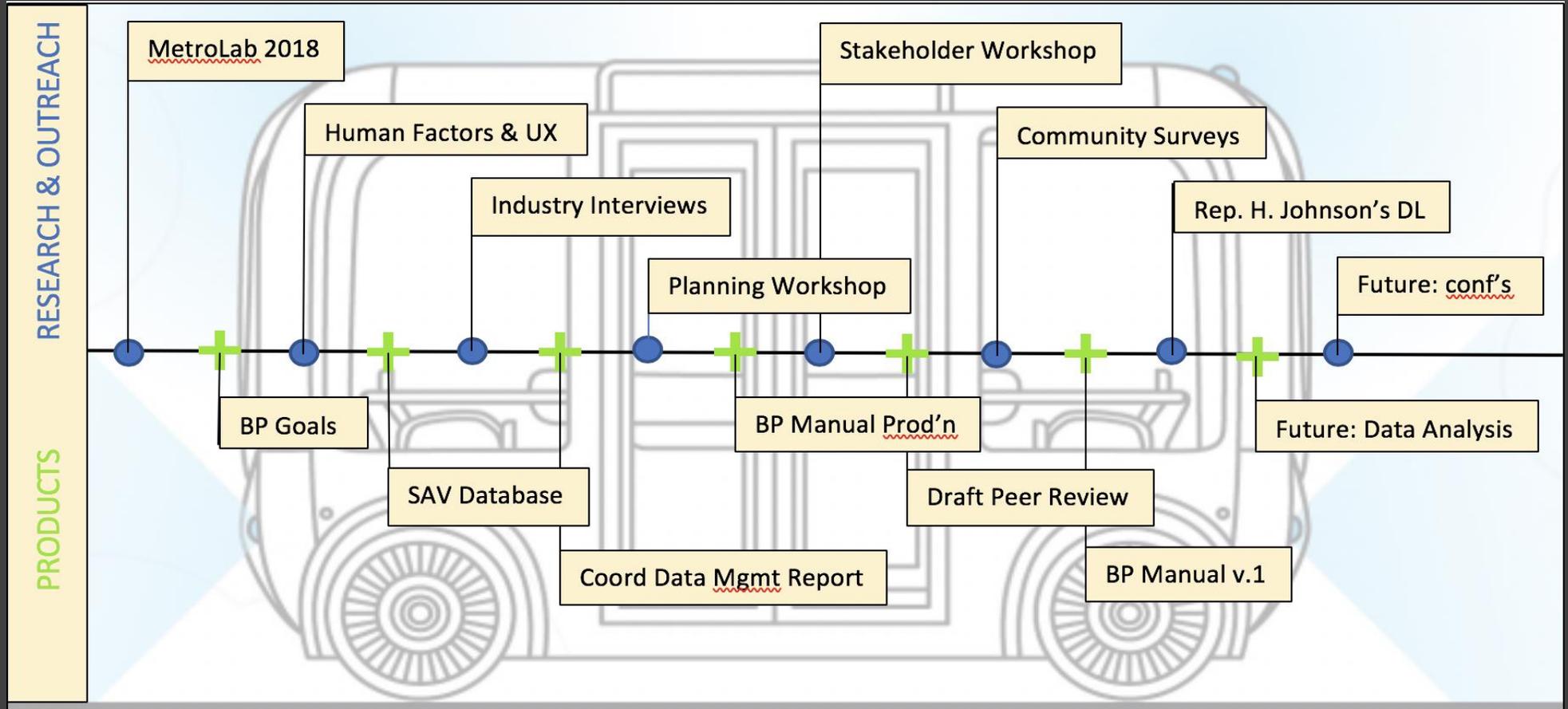
Best Practices Manual for User Experience in AV Shuttle  
(while helping communities use AV investments to meet multiple objectives)

"Bird Invasion", *Atlanta Magazine*. Illustration by Ryan Snook





# Research Production Timeline: Best Practices Manual for Improving User Experience on AV Shuttles



**Researcher Tips:** Collaborate early - especially on data collection, capacity, and resources. Consider industry peer reviewers. Leverage students!



**Planning For:** 15 years before planning an AV shuttle  
Chamblee's plans to revitalize its downtown core exemplified Best Practices for expanding mobility and building ridership.

1. **Create a vision, then use AV shuttles to support it**
2. **Build on the parking lots**
3. **Rezone to activate street frontages**
4. **Leverage growth and placemaking together**
  - Adopt policies to mitigate displacement from gentrification
5. **Plan the pedestrian experience**
  - Sidewalks
  - Street trees and streetscaping
  - Mid-block Rail Trail

Redevelopment sites along the mid-block rail trail (2016)





**Getting To:** The user's trip is door-to-door and the experience of getting to the transit is just as important as the ride itself.

### 1. Integrate AV shuttles into larger mobility networks

- Co-locate stops w ride-hailing stops, transit, bike paths, etc.

### 2. Expand multi-modal and "last mile" access

- Re-allocate public ROW to include bike lanes
- Identify ways to improve walkability with "walkshops"
- Consider improvements to the 2-3 mile bike-shed

### 3. Increase safety and trust with more "eyes on the street" near shuttle stops

- Appropriate night-lighting along major routes
- Encourage mixed uses near stops
- Use shuttle's "eyes on the street" to deter crime

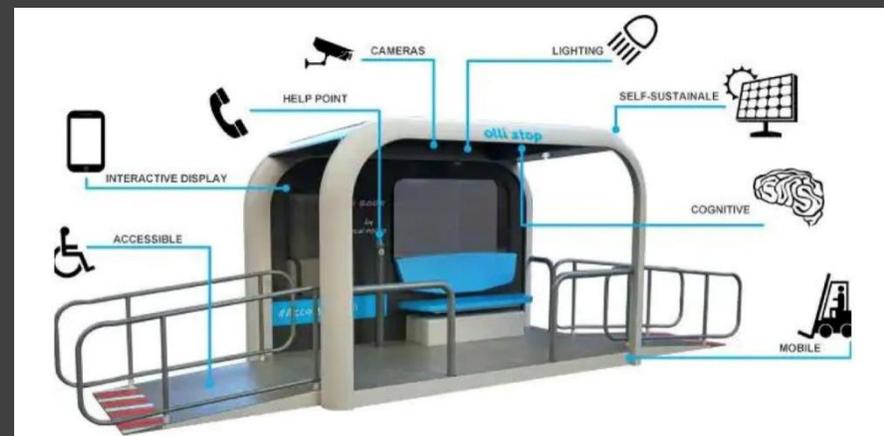
Community "walkshop" along Chamblee's AV route





**Waiting For:** What if AV shuttle bus stops made time spent waiting more productive, playful and community-oriented?

- 1. Exceed user's expectations on safety & comfort**
- 2. Provide real-time information on shuttle status**
- 3. Design stops BOTH to identify the shuttle system AND the individual stop's neighborhood**
- 4. Activate stops as community hubs**
  - Integrate stops with retail, parks, and other meeting places
  - Gather community input on neighborhood needs/desires that the stop could accommodate
- 5. Make waiting active time**
  - Wifi and recharging stations
  - Invitations to swing, play games, weed a garden



Key features of the Olli stop.

Photo by: Olli





Houston limo bus above; Florida AV school bus below

**Riding On:** All riders want easy, efficient service. Survey results were mixed, mostly along generational lines, on whether they would prefer a silent or social ride.

- 1. Define the role of the steward with users in mind**
  - Experiment: tour guide? social facilitator? "Mom"?
  - UK "Chatty Bus Day"
- 2. Select the seating arrangement with users in mind**
- 3. Use the flexibility of autonomy to advantage**
  - Custom-designed 3D printed vehicles
  - On-demand re-routing to designated stops
- 4. Seamless payment systems**
- 5. Recognize the value of all users' time**





**Managing Data:** Autonomy provides both enormous opportunities to collect, store, and manage data to improve user experience, operations, and city streets – as well as questions.

1. What data would be most useful?
2. How much data can the city store, for how long, and who will analyze it?
3. How will privacy be protected?

We asked GT ISYE Masters student Rey Angeles to shape a data management plan





# Smart Community Corps Impact

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- Data management process defined so the City has a path toward management when the shuttle is deployed.
- Advocate for the project to explore research and grant opportunities.



# Data Management Plan

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## Phase 1: AV Partner Selection

Define Data Governance  
Organization and Framework



## Phase 2: SAV Pilot

Double Diamond Process



## Phase 3: SAV Implementation

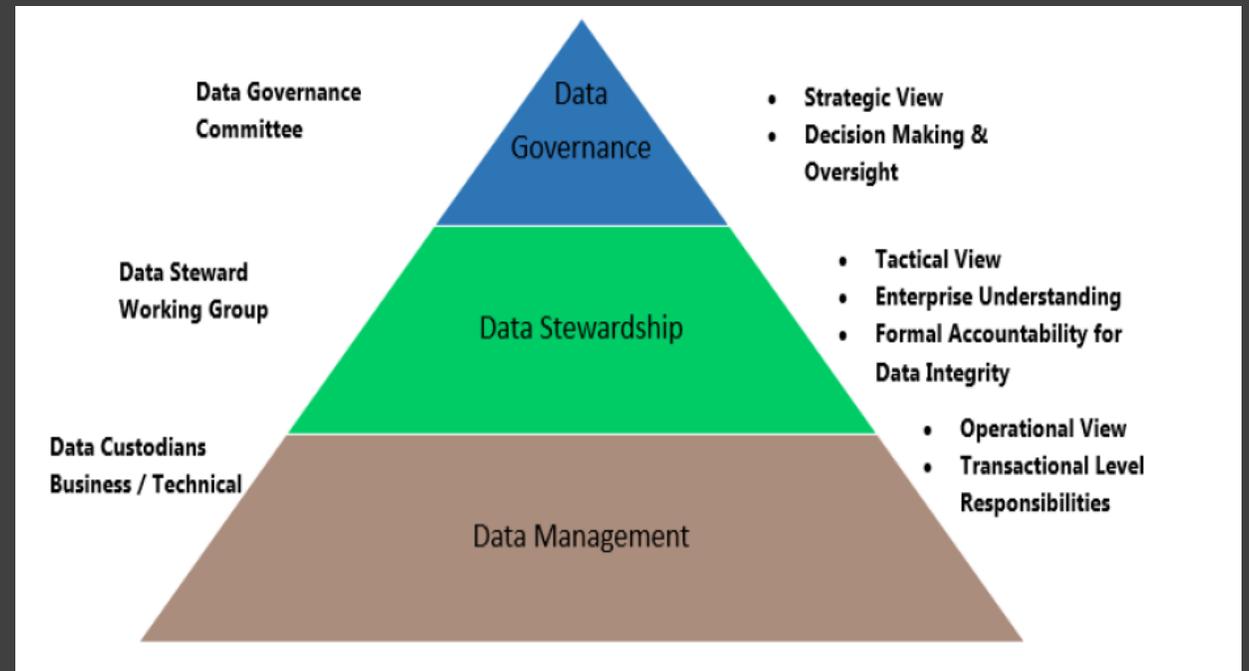
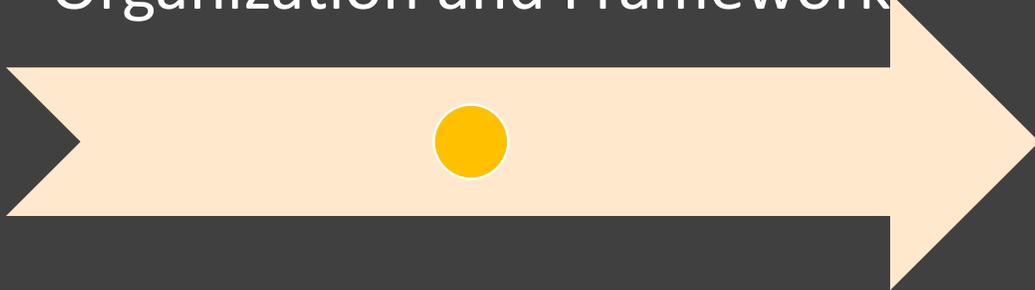
Data Collection via APIs  
Recollection of User Feedback via  
Survey/ Interview/ Social Media





# Phase 1: AV Partner Selection

Define Data Governance  
Organization and Framework





# Defining User Experience (UX) Metrics

## Getting To Waiting For Riding On

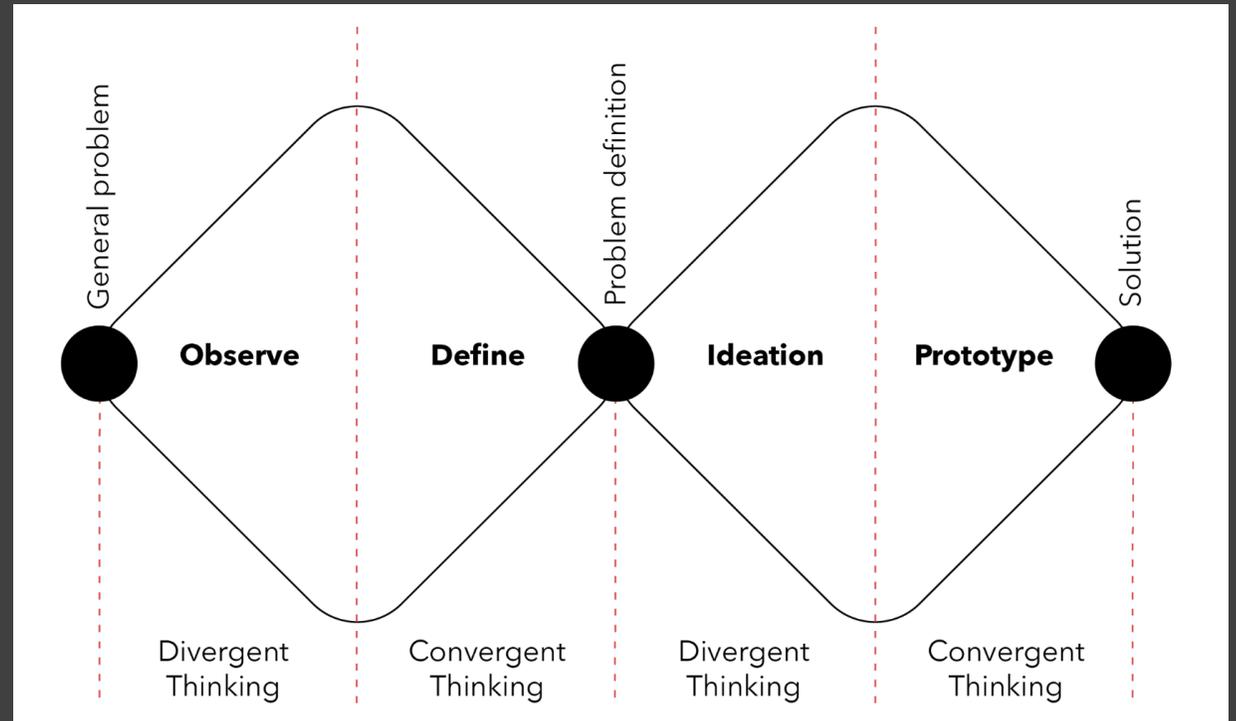
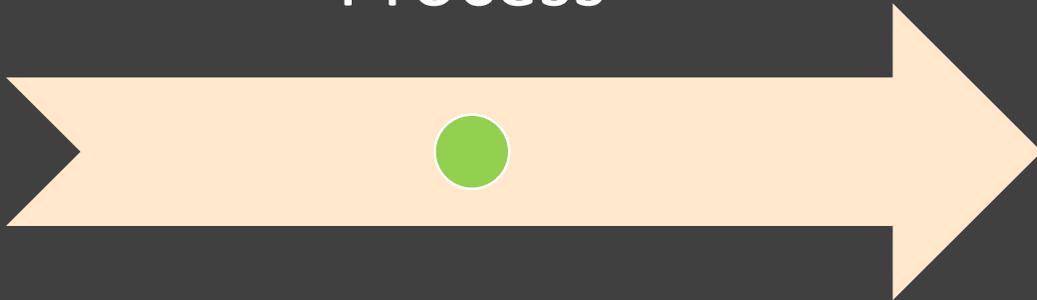
	Best Practices	Measures	Alternative Data Collection Methods
Getting To	Integrate AV shuttles into larger transit and pedestrian networks	Seamless transition between transit systems	GoogleMaps Platform (Distance Matrix API)
		Single payment card/ app	Open Data (DOT)
Getting To	Expand “last mile” multi-modal access to and from AV shuttle stops	Safety/ comfort – trees, lighting, benches	Customer Safari
		Multi-modal access	Open Data (DOT)
Waiting For	Exceed user’s expectations on providing them with safety, comfort, and respect	Comfortable seating setback from street	Customer Safari Journey Map Survey
Riding On	Consider Rider Comfort	Accessibility, atmosphere, security	Survey/ Interview Customer Journey Map
		Lighting, hard seats, cleanliness	Customer Journey Map
		Safe to ride alone – easy to read facial expressions and body language	ThirdSight (Emovision)
		Vehicle care incentives	Survey/ Interview



# Phase 2: SAV Pilot

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## Double Diamond Process





# Double Diamond Process

- Phase 1: Mapping Out
- Phase 2: Empathize
- Phase 3: Brainstorm Ideas
- Phase 4: Prototype on One



**Juana Ramirez**

*"Of course this has no solution"*

 Juana takes the bus occasionally to go see her daughter and grand-children.

Age: 74 years old  
Job: Retired  
Family: Daughter and grand-children  
City: Madrid  
Personality: Extroverted

**Bio**

Juana was born in Segovia and she moved to Madrid when she was very young. She got married with Arsenio and they have an only daughter. She took care of her family while she worked as a seamstress in a textile factory. She has been retired for 9 years.

She became a widow three years ago and her daily life consists in helping her daughter and her family.

She takes the bus occasionally to go to her daughter's house and to the hospital. Both buses lines stop close to her house so she doesn't need to walk much to get there.

**Motivations**

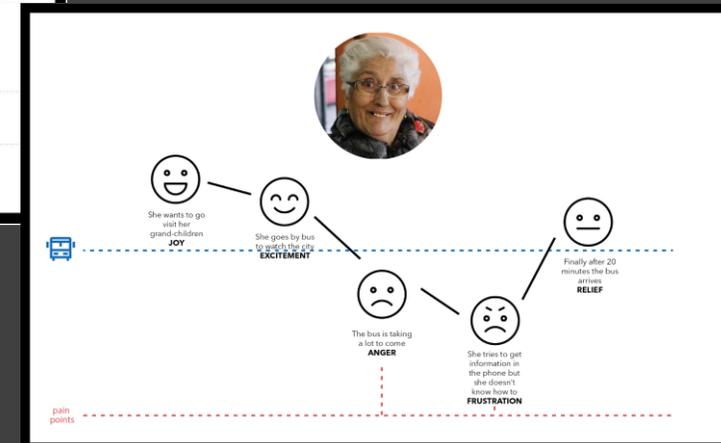
- Get on time to the doctor's appointment.
- Visiting her daughter who lives five stops away.

**Frustrations**

- That the bus doesn't arrive in time.
- The bus is crowded and she can't seat during the journey.
- I don't know if my ticket expired.

**Use of technology**

- She uses a mobile phone but she doesn't get it very well.
- She carries a small plastified paper with a phone list.

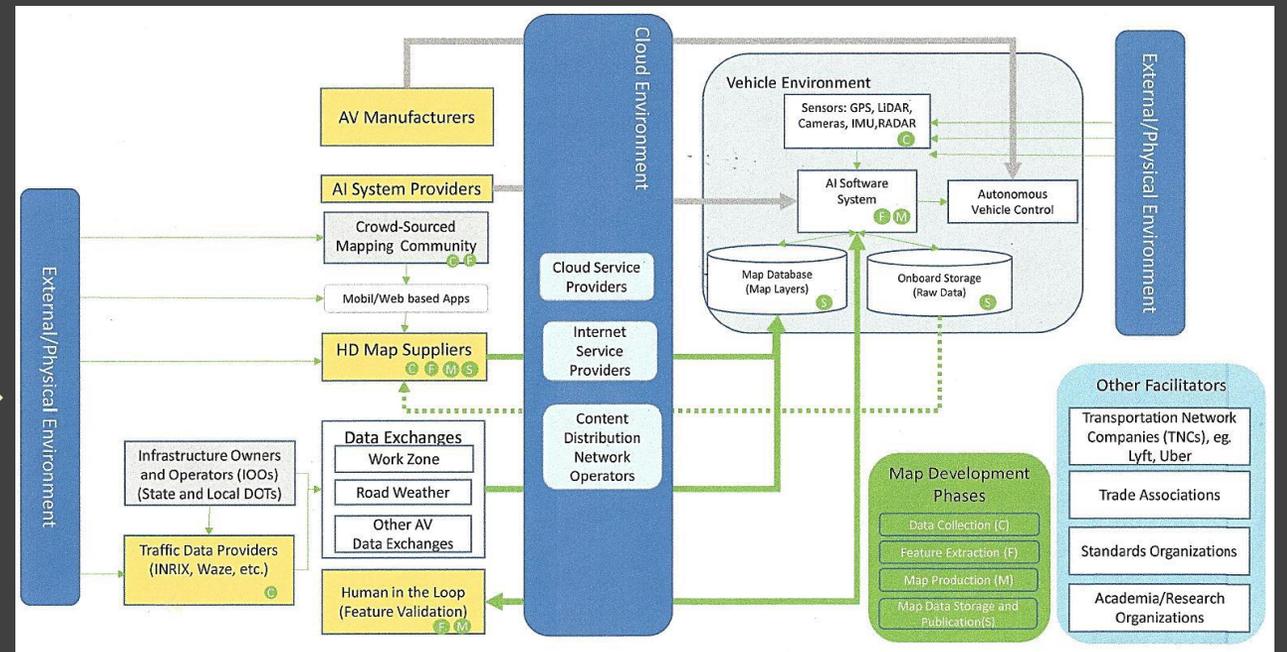
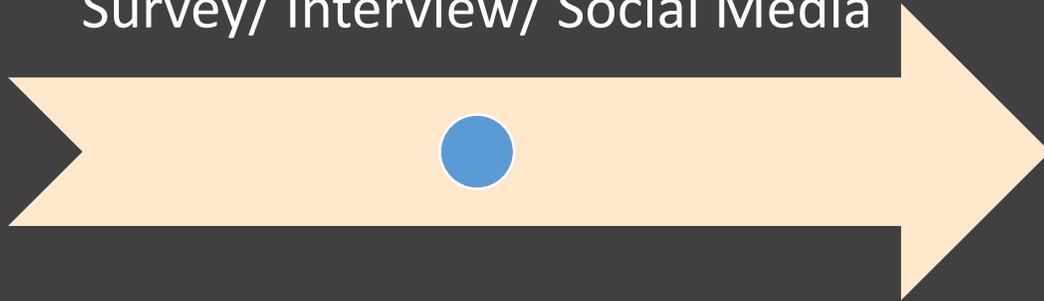




# Phase 3: SAV Implementation

Data Collection via APIs

Recollection of User Feedback via Survey/ Interview/ Social Media

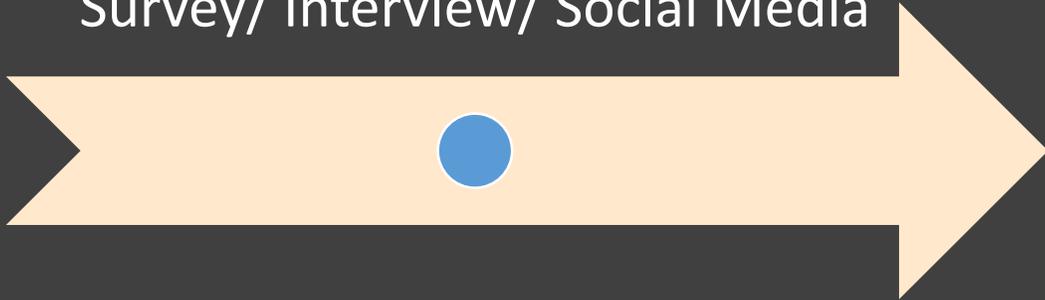




# Phase 3: SAV Implementation

Data Collection via APIs

Recollection of User Feedback via Survey/ Interview/ Social Media



**Shuttle Sensors/ Hardware**

**1** GNSS Antenna: global positioning system that communicates between the GPS sensor and a base station (GNSS RTK system) that provides precise positioning, accurate to the nearest centimeter

**2** Cameras: analyze vehicle's surroundings (road signs, traffic lights) and contribute to obstacle detection and identification

**3** IMU: measures vehicle accelerations and rotations, allowing vehicles to confirm positioning information and improve precision

**4** LIDARs (Laser Detection and Ranging) Sensors: Ensure detection of obstacles and calculate the vehicle's precise positioning via 3D-mapping

**5** GNSS Antenna: global positioning system that communicates between the GPS sensor and a base station (GNSS RTK system) that provides precise positioning, accurate to the nearest centimeter

**6** Odometry sensor: estimates and confirms the vehicle's location and speed while moving



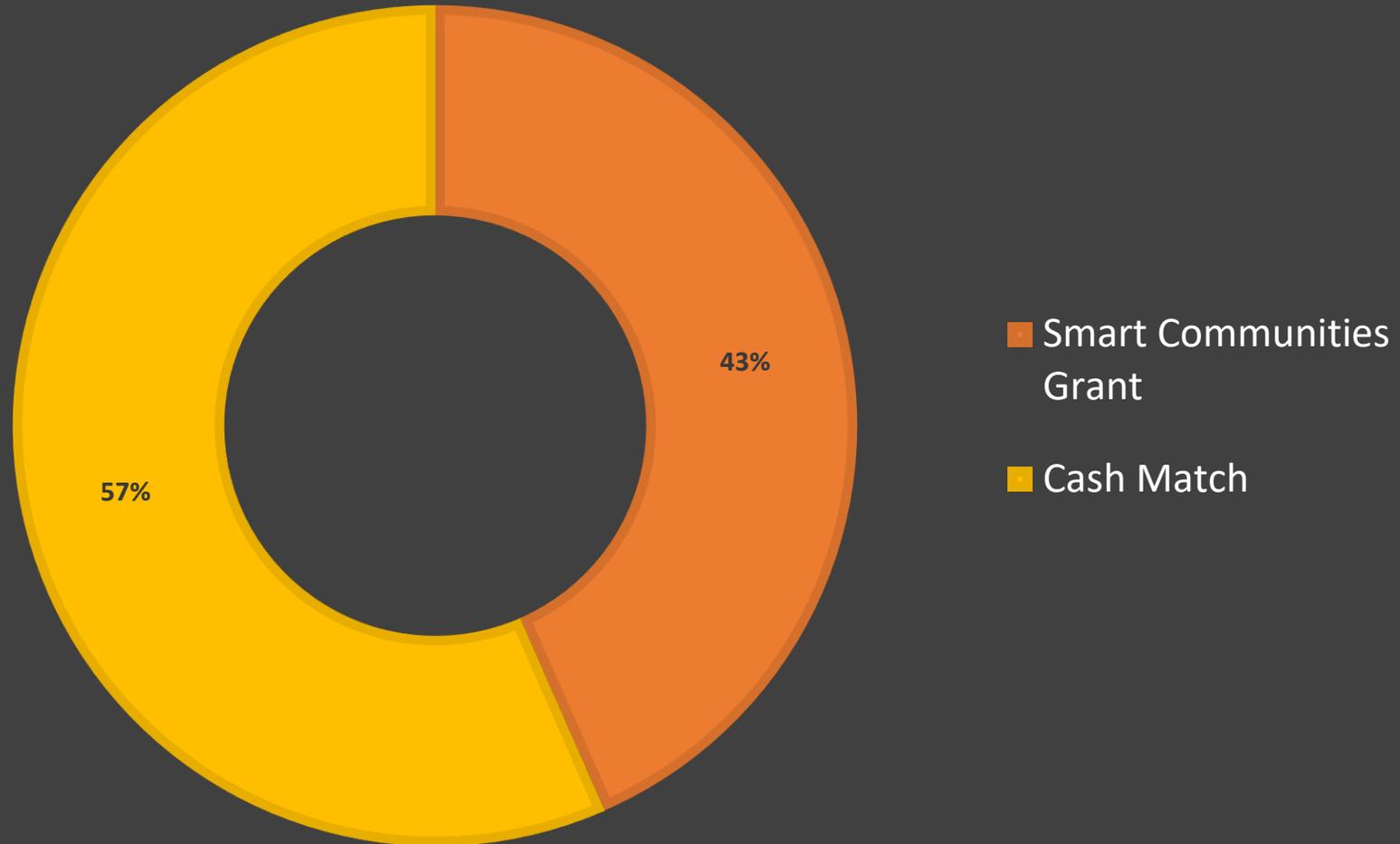
# Grant Monies Financial Reporting

Date	Match Type	Expense Title	Description	Total
01.07.19	Cash	Operations Plan - Stantec subconsultant services	Data collection and expenses	\$20,015.88
01.18.19	Cash	Operations Plan - Stantec subconsultant services	Data collection, system operations plan, concept development, deliverable prep	\$33,000.12
08.23.19	Cash	Operations Plan - Stantec subconsultant services	Data collection, system operations plan, concept development, deliverable prep	\$12,151.50
			Total	\$65,168.00



# Grant Monies Financial Reporting

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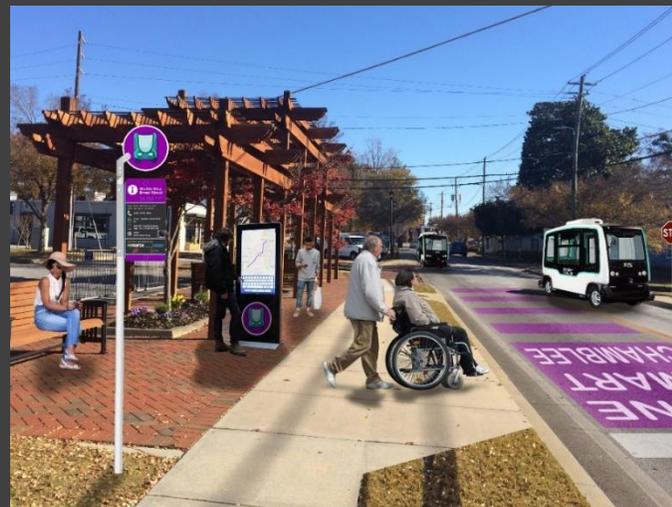




# Project Team Contact Information

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- Rebecca Keefer: Special Projects Manager, 770-639-7096, [rkeefer@chambleega.gov](mailto:rkeefer@chambleega.gov)
- Ellen Dunham-Jones: Professor; Director, Urban Design Program [ellen.dunham-jones@design.gatech.edu](mailto:ellen.dunham-jones@design.gatech.edu)
- Rey Angeles: Smart Community Corps Intern, [rangeles@gatech.edu](mailto:rangeles@gatech.edu)





# Appendices

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- Automated Shuttle Detailed Design Plan
- Best Practices Manual v.1

# CHAMBLEE

## Automated Shuttle Detailed Design Plan

---

City of Chamblee, Georgia  
Stantec



05-21-19

**Prepared for  
City of Chamblee**



## **Acknowledgments**

### **City of Chamblee City Council**

Mayor R. Eric Clarkson  
Mayor Pro-Tem Darron Kusman  
Brian Mock, At-Large  
John Mesa, District 1  
Thomas Hogan, District 3  
Leslie Robson, District 2

### **The City of Chamblee Staff**

Matt Dickison, Planning and  
Development Director  
Jon Walker, City Manager  
Andrew Russell, Senior Planner  
Taylor Baxter, Planning and  
Development Deputy Director  
Rebecca Keefer, Special Projects  
Manager

### **Key Stakeholders**

MARTA  
Atlanta Regional Commission  
Downtown area developers  
Peachtree Road businesses  
Peachtree Road local residents

**Prepared by  
Stantec**



## **Project Team**

Craig Lewis, Principal-in-Charge  
Michelle Orfield, Project Manager  
Frank Domingo  
Matt Washing  
Jonathan Garrett  
Ashley Bonawitz  
Richard Pascoe

**Note: This project was completed in conjunction with the Smart Community Challenge with GA Tech**

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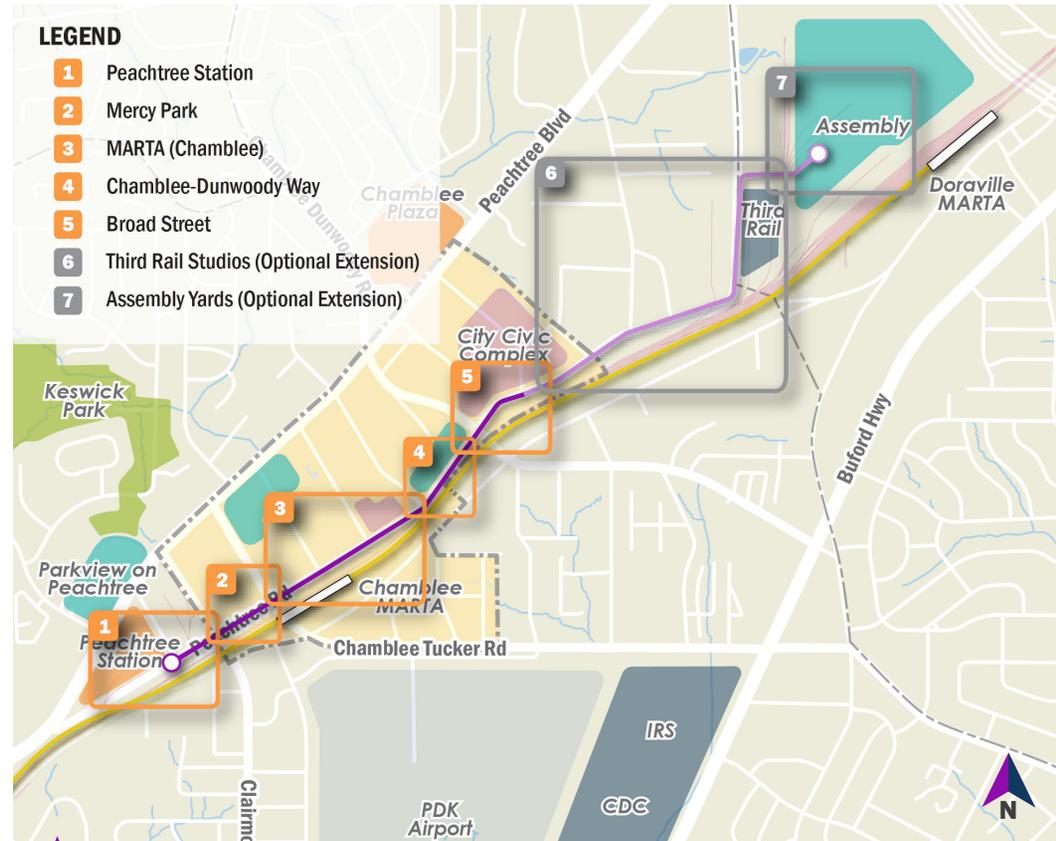
# **CHAPTER 1**

## Introduction

# 1.0 Introduction

An automated shuttle on Peachtree Road will provide vital first/last-mile connections for residents, commuters, and visitors and will work seamlessly with already available local and regional transportation options.

Peachtree Road runs parallel to Peachtree Boulevard and serves many of the same businesses, retail establishments, and residential areas. Peachtree Road, though, is set to become a much more walkable, urban street, while Peachtree Boulevard remains an automobile-centric thoroughfare. Continuing streetscape work will add many traffic calming measures that make it easier for pedestrians and bicyclists to travel between their homes, workplaces, and the many retail destinations along Peachtree Road. An automated shuttle on Peachtree Road will provide vital first/last-mile connections for residents, commuters, and visitors and will work seamlessly with already available local and regional transportation options. As shown in the map to the right, the route connects Peachtree Station, a retail and services center including Whole Foods, to the local businesses and civic center at Broad Street, to Third Rail Studios and the Assembly Yards mixed-use redevelopment.



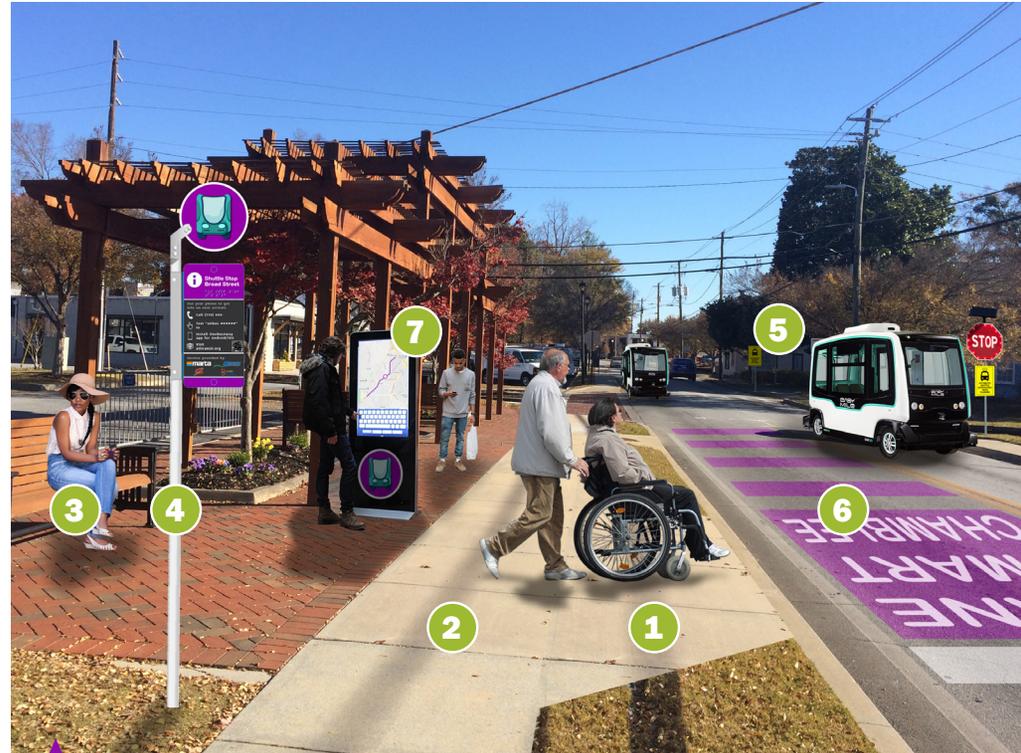
Overall route map with each of the seven segments identified: Peachtree Station, Mercy Park, MARTA (Chamblee), Chamblee Dunwoody Way, and Broad Street with optional extensions to Third Rail Studios and/or Assembly Yards

This report documents automated shuttle operational details, risks, and the corresponding conditional improvements for an automated shuttle route on Peachtree Road. The recommendations may not be necessary depending on the vehicle manufacturer, seeing as the sophistication of the technology and degree of testing varies by company. Standard terminology is used to indicate if the recommendation is required, recommended, or optional. Input from the manufacturers, operator, City staff, City Council, and other officials may help determine the degree of investment.

**Required:** Required improvements are mandatory for automated shuttle operations as determined by engineering judgment.

**Recommended:** Recommended improvements are advised for automated shuttle operations but may be omitted with a justifiable cause and in consultation with the operator.

**Optional:** Optional improvements to enhance automated shuttle operations.



Example of a proposed stop with required, recommended, and optional improvements called out: 1-2) Required: ADA concrete landing pad and sidewalk connectivity; 3-6) Recommended: bench, signage, advisory signs, and pavement markings; 7) Optional: Interactive map kiosk



# **CHAPTER 2**

## Glossary

## 2.0 Glossary

Automated shuttles are small (8-16 passengers), low speed (<25 mph) electric shuttles that perform many driving tasks without an active human driver. They are currently Level 4 - High Automation according to SAE J3016.

**SAE J3016:** Society of Automotive Engineers (SAE) Recommended Practice for the Taxonomy and Definitions for Terms Related to Driving Automation Systems for On-Road Motor Vehicles. SAE defines six levels of driving automation, as shown in the below graphic.



**V2I:** V2I (Vehicle to infrastructure) communication allows communication between vehicles (in this case automated shuttles) with select infrastructure, such as signalized intersections. Today, V2I communication is commonly achieved through cellular or radio hardware.

**Flashing Beacon STOP:** A STOP sign with embedded LEDs that activate while an automated shuttle is present to provide additional advisory information to road users. Flashing beacon STOP signs are V2I-enabled and include a generic yellow advisory sign to indicate that the intersection is an automated shuttle crossing.

**Rectangular Rapid Flash Beacon (RRFB):** User-actuated amber LEDs that accompany pedestrian crossing warning signs.

**Near-side Stop:** A near-side transit stop is located immediately before an intersection.

**Far-side Stop:** A far-side transit stop is located immediately after an intersection.

**Midblock Stop:** A midblock transit stop is located outside of an intersection's operational area.

**Required:** Required improvements are mandatory for automated shuttle operations as determined by engineering judgment.

**Recommended:** Recommended improvements are advised for automated shuttle operations but may be omitted with a justifiable cause and in consultation with the operator.

**Optional:** Optional improvements to enhance automated shuttle operations.

**Headway:** The measurement of time between automated shuttles at a proposed stop; also known as time headway.



Flashing Beacon STOP sign with embedded LEDs and additional advisory information



# **CHAPTER 3**

## **Route Overview**

## 3.0 Route Overview

The automated shuttle route is separated into seven distinct areas, each anchored by a proposed stop: Peachtree Station, Mercy Park, MARTA (Chamblee), Chamblee Dunwoody Way, Broad Street, Third Rail Studios, and Assembly Yards.

As one of a small number of mixed-traffic automated shuttles in North America, Peachtree Road will be unlike any other, and as such, needs to orient users to the new operating conditions. It is recommended that the implementation of an automated shuttle on Peachtree Road include extra signage and safety features to ensure successful and safe testing. As shown in the map on the next page, the automated shuttle route is separated into seven distinct areas, each anchored by a proposed stop.

The proposed core automated shuttle route is 2.2 miles (roundtrip) with 5 stops, including a connection to the MARTA Gold Line and Bus Routes 103, 132, 825, and 408 at MARTA's Chamblee Station. Five proposed stops: Peachtree Station, Mercy Park, MARTA (Chamblee), Chamblee Dunwoody Way, and Broad Street comprise the core route. The core route serves as a vital first/last-mile connection for those that live, work, shop, and dine in the developments along Peachtree Road. The core route is also very conducive to safe automated shuttle operations, with an array of traffic calming measures and multi-modal accommodations.

### Operational details for core route are shown below:

- » **Core Route Distance (roundtrip):** 2.2 miles
- » **Headway:** 15 minutes (1 automated shuttle in service); 7.5 minutes (2 automated shuttles in service) at an operating speed of 12 mph. Includes a 30 second dwell period per stop.
- » **System Capacity:** 45 persons/hour/automated shuttle

The extended route is 4.2 miles (roundtrip) and adds stops at Third Rail Studios and Assembly Yards. The stops at Third Rail Studios and Assembly Yards connect these employment and future residential areas with businesses and services along Peachtree Road. To safely serve these employment centers, efforts to calm traffic and reduce driveway access are required. Overall, the route requires only modest infrastructure improvements for implementation and creates meaningful connections between destinations.

### Operational details for the extended route are shown below:

- » **Extended Route Total Distance (roundtrip):** 4.2 miles
- » **Headway:** 30 minutes (1 automated shuttle in service); 15 minutes (2 automated shuttles in service) at operating speed of 12 mph. Includes a 30 second dwell period per stop.
- » **System Capacity:** 26 persons/hour/automated shuttle





# **CHAPTER 4**

## **Route Analysis & Design**

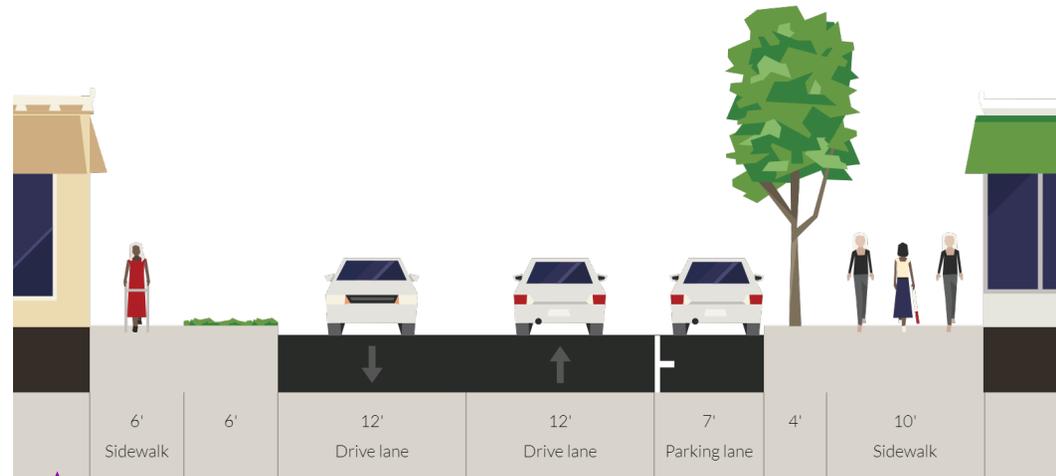
## 4.0 Route Analysis & Design

This section documents the required, recommended, and optional improvements to infrastructure along the automated shuttle route, beginning in the southwest at Peachtree Station and extending northeast to Assembly Yards.

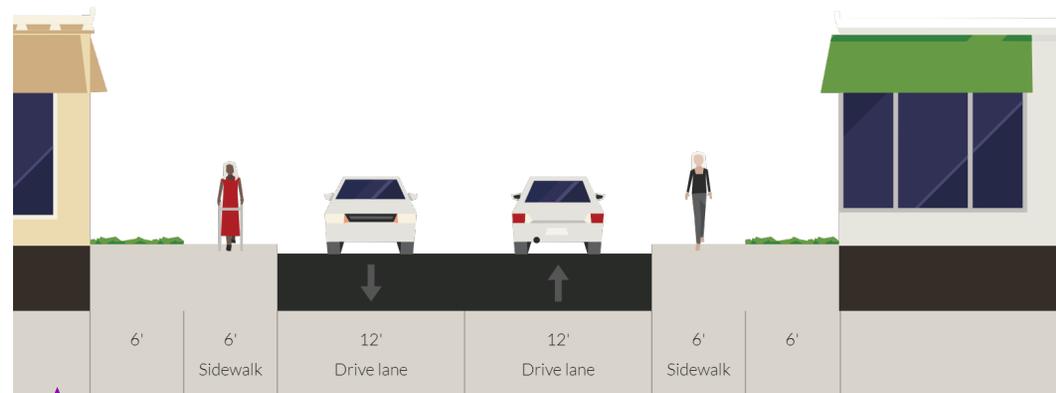
From McGaw Drive to American Industrial Way, the analysis of existing conditions is based on future conditions described in the Peachtree Road Streetscape Plans (“streetscape plans”). At the beginning of the corridor, the intersection of McGaw Drive and Peachtree Road is established as a three-way stop. Through the entire streetscaped corridor, the roadway cross section is limited to two-lanes (11 or 12-foot travel lanes) with intermittent on-street parking and a desired 25 mile per hour speed limit (new permit will be required). This cross section is an effective traffic calming measure that simplifies automated shuttle operations and maximizes safety.

For the route corridor north of American Industrial Way, the route analysis is based on existing conditions. The speed limit varies between 30 and 35 miles per hour and the roadway is mostly two lanes (11 or 12-foot travel lanes), with a few right-turn pocket lanes. The frequency of driveway cuts on Peachtree Road also increases north of American Industrial Way.

There are also important automated shuttle operating characteristics to consider. Merging and lane-change movements are cumbersome for automated shuttles, and as such, automated shuttle stops are recommended in the travel lane. Since Peachtree Road is two-lanes and passing is prohibited, automated shuttles may increase delay for following vehicles during boarding and alighting. Dwell time delay may be further exacerbated



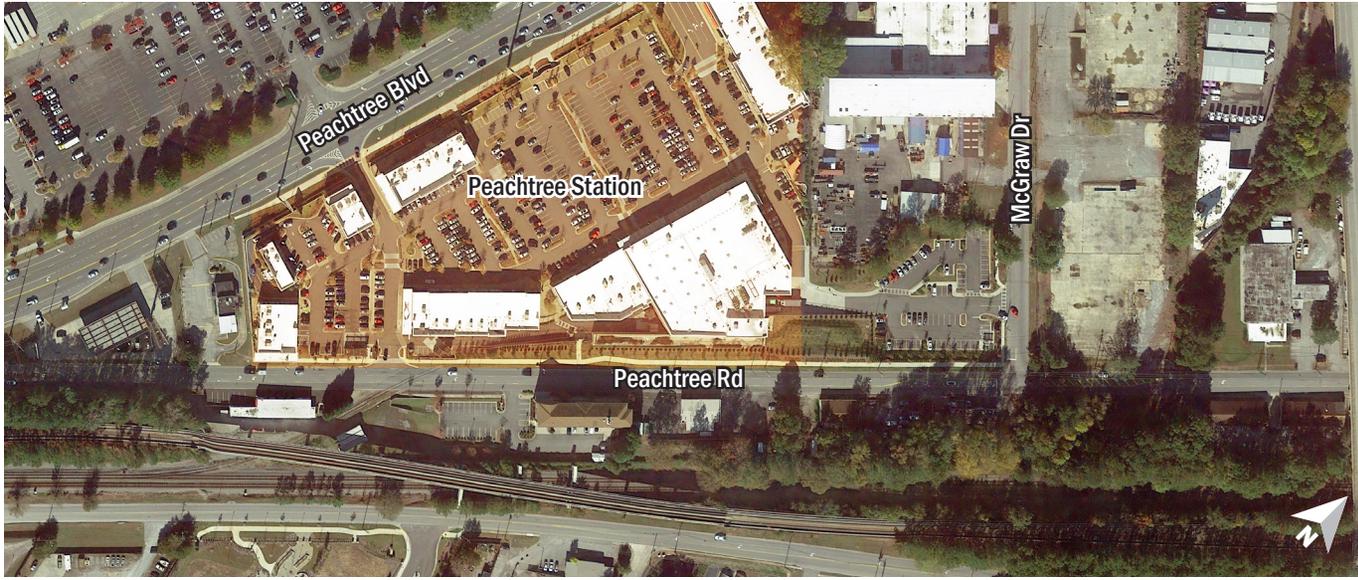
Typical Peachtree Road cross section with streetscape improvements



Typical existing Peachtree Road cross section



## 4.1 Peachtree Station



Peachtree Station segment overall map with the principle destination at Peachtree Station identified in orange

### 4.1.1 Overview

Peachtree Station anchors the proposed automated shuttle route on the southwest and is a principal destination that includes Whole Foods, multiple restaurants, and other service-related businesses. The Peachtree Station analysis area extends from the intersection of McGaw and Peachtree Road to the Clairmont Road flyover. Each of the stop and turn-around options require easement agreements from private property owners.

### 4.1.2 Southern Terminus - Preferred Stop and Turn-Around Option

As the southern route termini, the automated shuttle must make a combination of turns (including left turns) at Peachtree Station to reorient the vehicle for the northbound journey. In addition, the Peachtree Station stop has the potential to be one of the busiest, which makes the automated shuttle dwell and pedestrian queue area even more critical. The preferred stop location at Peachtree Station is located within the development's secondary parking lot, is less than 300 feet from Whole Foods, and within a 5-minute walk (1000 ft) or less of the southernmost edge of Peachtree Station.

### 4.1.3 Southern Terminus - Alternate Stop A

Southern Terminus - Alternate Stop A is a mid-block stop southwest of McGaw Drive. The mid-block stop has enough space for stop amenities (e.g., bench, shelter, etc.) and is adjacent to stairs that provide central access to Peachtree Station. However, the stairs do not provide direct access for handicapped or disabled riders.

### 4.1.4 Southern Terminus - Alternate Stop B

Southern Terminus - Alternate Stop B is further southwest of Alternate A, within the Peachtree Station primary parking lot. The automated shuttle enters the lot from the central driveway access on Peachtree Road, reorients for the northbound journey, and stops for boarding and disembarking passengers. This option provides the most direct access to Peachtree Station for all users but is constrained by space.

### 4.1.5 Southern Terminus - Alternate Turn-Around

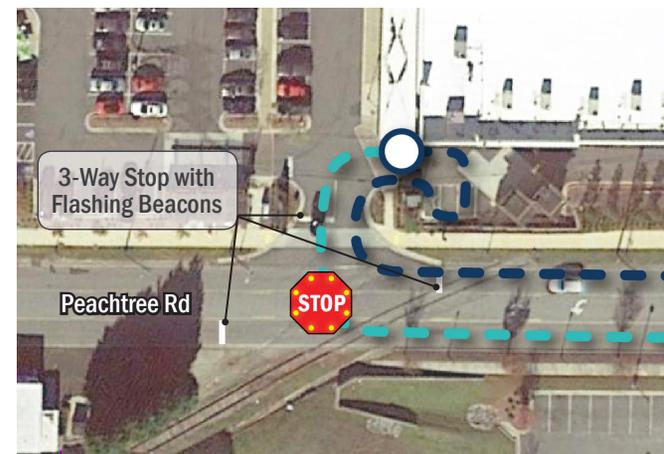
Southern Terminus - Alternate Stops A and B share a common turn-around location. This location is more centrally located to Peachtree Station compared to the preferred southern stop and turn-around location. However, the alternate location is less preferred because of the character of Peachtree Road and the high utilization of the adjacent parking lot, which also involves conflicts with commercial business deliveries and dumpster loading.

The current city streetscape program does not extend beyond McGaw drive. The transition from a two-lane cross-section to three-lane cross section with a two-way left turn creates a new operating environment that is less suitable for automated shuttles. For example, prevailing travel speeds on Peachtree Road southwest of McGaw Drive exceed the comfortable range for many automated shuttle manufacturers and the two-way left turn has many operational nuances that are difficult for automated shuttles to process.

At the driveway intersection, Peachtree Road has the right of way while the driveway is stop-controlled. Further, sight distance for vehicles exiting Peachtree Station is limited by the Peachtree Station sign and landscaping. To accommodate a turn-around at this location, it is recommended that the Peachtree Station driveway and Peachtree Road intersection be converted to a three-way, stop-controlled intersection. Within the parking lot, an automated shuttle-exclusive zone and advisory signage are recommended to help separate the automated shuttle from the primary parking operations.



Southern Terminus and Stop Options: preferred and alternates A & B



Shared common turn-around location for alternate stops A & B

## 4.1.6 Preferred Stop Infrastructure Modifications

### Automated Shuttle Stop

Within the secondary Peachtree Station parking lot, minor modifications will create a distinct terminus with a safe operating area for the automated shuttle and its users. This terminus location already has ADA accessible sidewalks, a pergola, and benches that could serve as an automated shuttle stop without additional investment, though the pergola is recommended to be converted to a covered refuge area. The secondary parking lot also provides ample space for riders to queue and seek refuge from the roadway. The preferred stop location at the existing pergola does not provide direct pedestrian connection to the Peachtree Station sidewalks. A painted pedestrian walkway across the McGaw Drive driveway is recommended to delineate pedestrian connection to Peachtree Station and alert vehicles to pedestrian activity. Many of these existing amenities will help to attract and sustain ridership for the automated shuttle.

Modest infrastructure modifications can transform Peachtree Station into a safe and efficient route terminus. Navigating the parking lot poses moderate risk for the automated shuttle, particularly if the area is not distinguishable from a standard parking lot. An automated shuttle-exclusive zone within the parking lot is recommended to separate the automated shuttle from parking operations, which are frequently unpredictable. If parking spaces along the preferred automated shuttle path remain, it is recommended that advisory signage and pavement markings be added to alert drivers of the automated shuttle's operation and path.



Existing conditions photo of the southern terminus - preferred stop and turn-around location



Existing conditions photo of the pergola and benches to potentially use at the stop location

## Peachtree Road / McGaw Drive Intersection

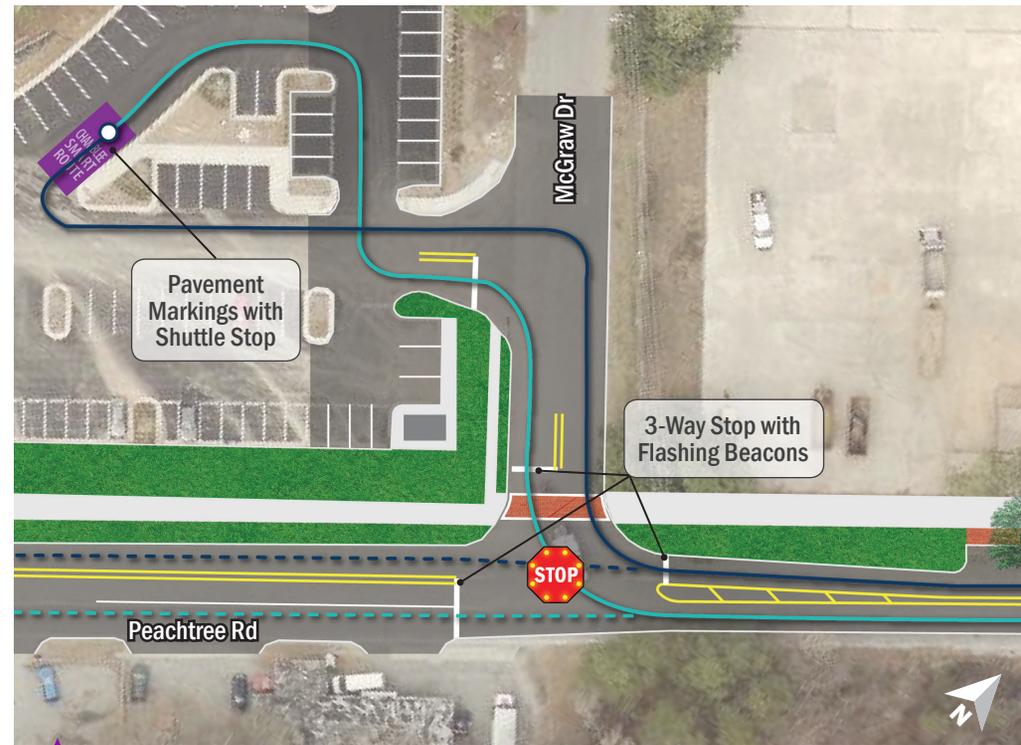
Whether the vehicle is human-operated or automated, left turns with opposing traffic involve tracking the speed and behavior of opposing vehicles. This trajectory estimation includes inherent uncertainty. The terminus at Peachtree Station features two left turns, one into the Peachtree Station parking lot from McGaw Drive, and a second from McGaw Drive to northbound Peachtree Road.

### Recommended and optional safety enhancements are listed below:

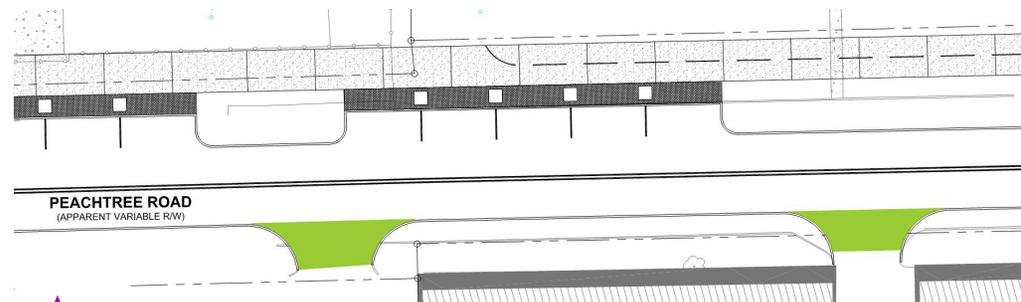
1. Southbound from McGaw Drive into the parking lot: No modifications are required but it is recommended to add advisory signs to inform oncoming traffic of the automated shuttle's operation. Pavement paint to clearly delineate the automated shuttle's path is optional.
2. Northbound from McGaw Drive onto Peachtree Road: To enhance the safety of the automated shuttle at this 3-way stop intersection, it is recommended to add advisory signs and pavement paint to distinguish the unique operations of this intersection. An optional safety enhancement at this intersection is to add flashing beacon STOP signs and/or a raised table intersection. The flashing beacon STOP signs have V2I connection with the automated shuttle and operate similar to RRFBs.
3. The optional raised-table intersection adds an additional traffic calming measure to limit automated shuttle-operational risk by reducing vehicle speeds.

### Additional Considerations

Three commercial properties along Peachtree Road, two on the eastern side and one on the western side, have driveway access. Sight lines between the driveways and Peachtree road are obstruction-free. No improvements are recommended at these locations.



Southern Terminus - Preferred Stop and Turn-around Location with preferred modifications



Additional Considerations Diagram: Green driveways have no operational concerns for the automated shuttle

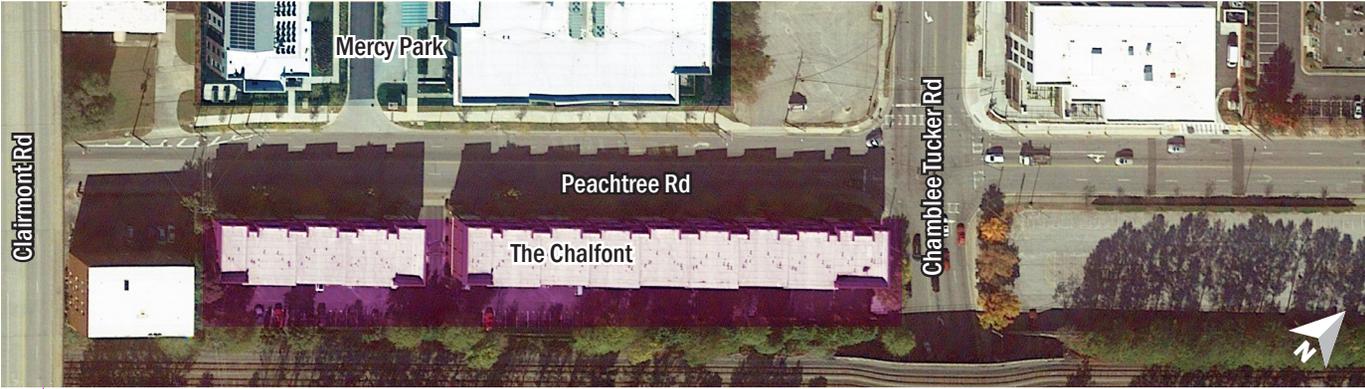
## 4.2 Mercy Park

### 4.2.1 Overview

Mercy Park, which consists of Mercy Care and Mercy Housing, and the adjacent study area extends from the Clairmont Road flyover to the far-side of Chamblee Tucker Road. The primary traffic generators and destinations in this area include Mercy Park, a medical clinic for underserved populations, residential townhomes, an affordable senior housing complex, and the MARTA Chamblee Park-and-Ride lot. By locating a stop adjacent to Mercy Park, key trip generators are served (residential townhomes) and a critical first/last-mile mobility service is made available to residents and patients at the Mercy Park development, who need reliable access for treatment.

Also, the rail-trail crosses Peachtree Road as a raised crosswalk southwest of the Mercy Park driveway. The rail-trail crossing includes RRFBs to indicate the presence of pedestrians or bicyclists in the crossing.

Within the Mercy Park area is the Chamblee Tucker Road intersection, the only signalized intersection along the entire route. At the signalized intersection of Peachtree Road and Chamblee Tucker Road, Peachtree Road widens to accommodate left-turn lanes in both directions. Chamblee Tucker Road has two through lanes and one left-turn lane in each direction. Pedestrians are accommodated with at-grade crosswalks, and a pedestrian-only “scatter” phase where pedestrians can cross the intersection in any direction.

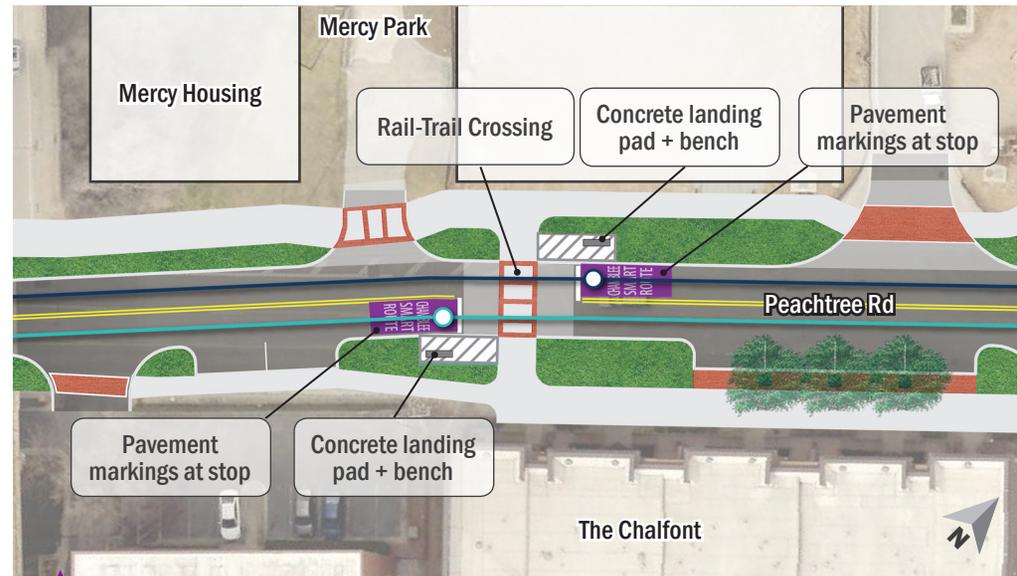


Mercy Park segment overall map with the principal destination at Mercy Park identified in blue

### 4.2.2 Preferred Stop Locations

The preferred southbound stop location is on the near-side of the rail-trail crossing. The near-side stop is preferred because trailing vehicles will anticipate a stop at the raised cross-walk and it combines two “stops” into one: a yield to pedestrians/bicyclists and an automated shuttle stop. The stop location is centrally located between Mercy Park, the townhomes, and the rail-trail crossing.

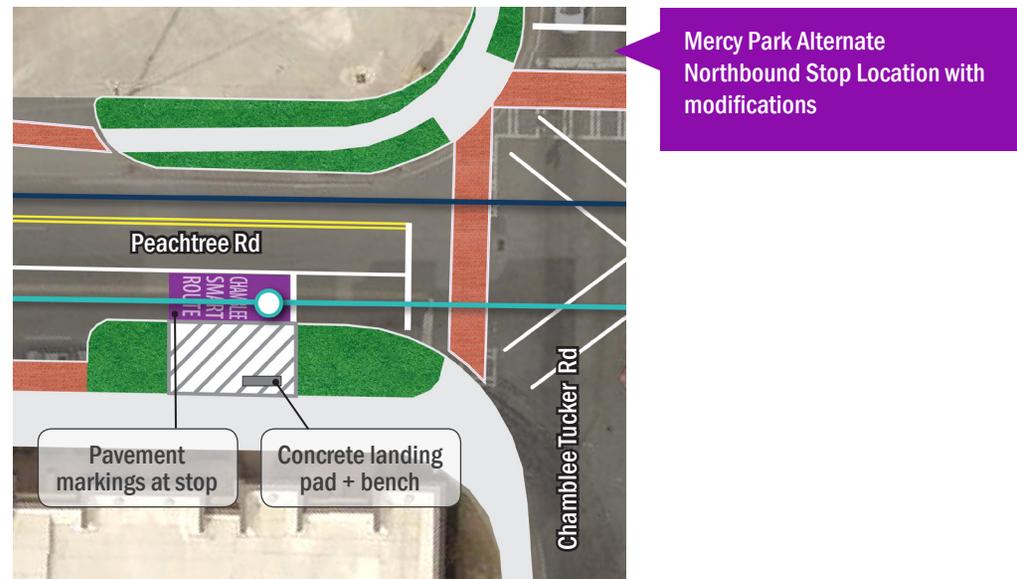
The preferred northbound stop location is also near-side of the rail-trail crossing. By maintaining proximity between the southbound and northbound stop locations, the route remains intuitive for riders. Both stops are directly connected to the nearby townhomes and Mercy Park facilities with sidewalks and raised crosswalks. At the preferred stops near-side the rail-trail, the Wal-Mart shopping center and the Oliver (formerly Olmsted) development is an 8-minute walk (1700 feet) and Mercy Park is a 1-minute walk (200 feet).



Mercy Park Preferred Stop Location with modifications

### 4.2.3 Alternate Stop Locations

The alternate stop locations provide more direct connections to Chamblee Tucker Road; however, the placement of these adds complexity to user trip planning and reduces access to Mercy Park. The alternate northbound stop is on the near-side of the Chamblee Tucker Road intersection with access to the rail-trail. The northbound near-side stop also reduces the safety and efficiency of the Chamblee Tucker Road intersection by reducing effective green time and introducing potential conflict with the northbound movements. Vehicles queued behind a dwelling automated shuttle may utilize the left-turn pocket to pass the automated shuttle, which is a dangerous movement. From this location, the Wal-Mart shopping center and the Oliver development is a 5-minute walk (1000 feet) and Mercy Park is a 3-minute walk (600 feet).



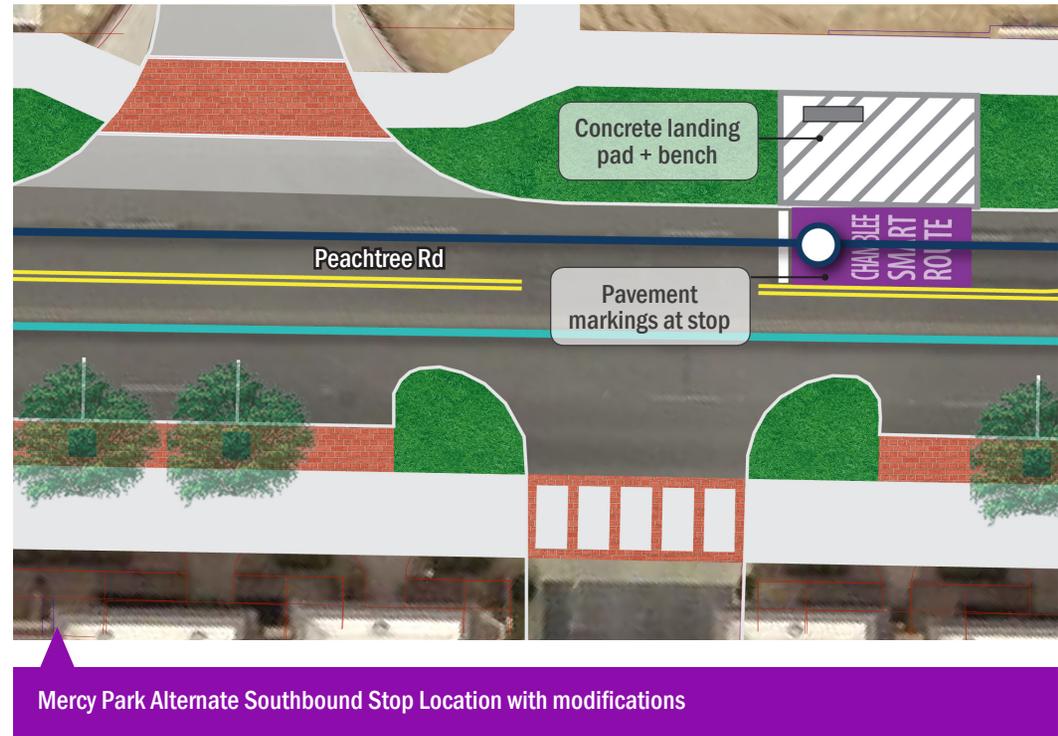
Mercy Park Alternate Northbound Stop Location with modifications

The alternate southbound stop is positioned in advance of the townhomes' driveway and within 75 feet of Mercy Park's front entrance. The staggered locations of the alternate stops are less intuitive for users and reduces consistency along the route. Further, the alternate southbound stop is located mid-block, which is less preferred than near-side a crosswalk or intersection since the mid-block stop encourages jaywalking.

#### 4.2.4 Infrastructure Modifications

##### Automated Shuttle Stops

In the immediate vicinity of the preferred stops, no modifications are required for safe operation. The streetscape plans help to create a low-speed roadway that provides safe operations for all users, whether by foot, vehicle, or automated shuttle. At the proposed stop locations, a concrete landing pad (8 feet wide by 5 feet deep) and sidewalk connectivity (minimum 4 feet wide) are required for ADA-accessibility. Additional stop amenities, such as pavement delineation paint, a bus stop sign, a bench, and system map are also recommended.



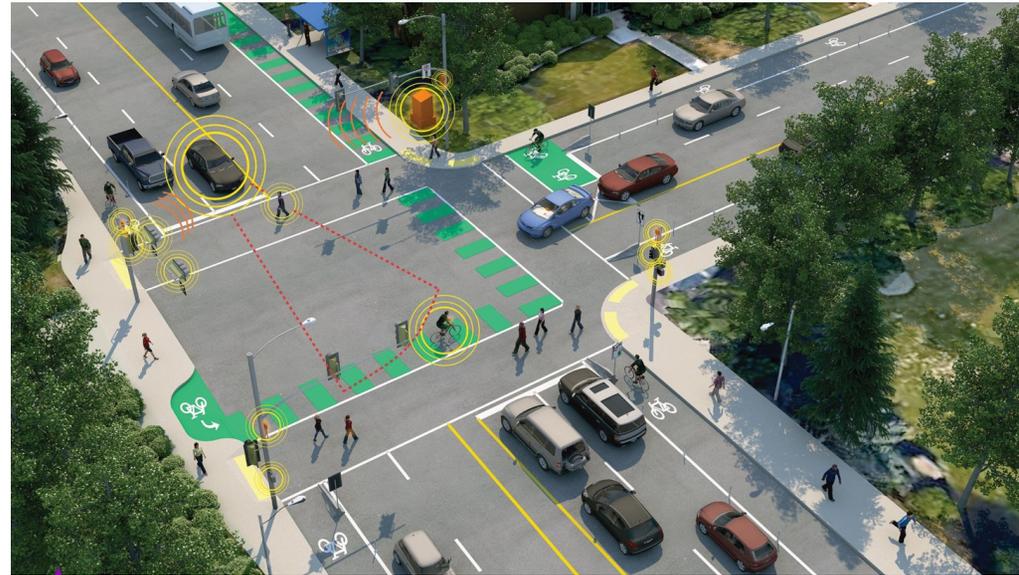
## Peachtree Road / Chamblee Tucker Road Intersection

Automated shuttle operations at signalized intersections require vehicle-to-infrastructure communication (V2I), such as cellular or radio. Either cellular or radio hardware communicates the signal phase to the automated shuttle. This communication may also be used to implement transit signal priority or emergency vehicle preemption if desired. A preliminary connected intersection design is provided in Appendix A.

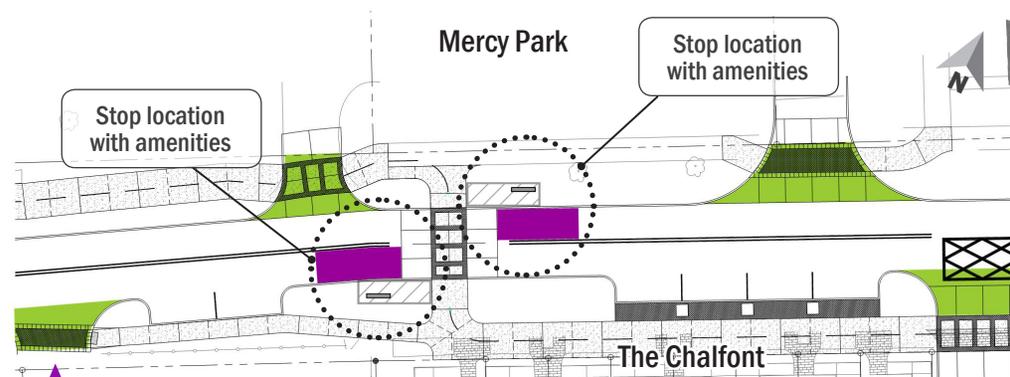
### Additional Considerations

There are several driveways in the Mercy Park area, but none that create operational issues for the automated shuttle. Each driveway has a clear sightline to Peachtree Road. Only one driveway (the Downing Atlanta, Inc driveway), directly across from the northbound stop, is within the automated shuttle stop influence area. However, the driveway is low-volume and has a raised table pedestrian crossing. The raised table pedestrian crossing adds an element of traffic calming to driveway movements, thereby reducing automated shuttle operational risk. The driveways do not require any infrastructure improvements.

At the rail-trail crossing, RRFBs are provided for rail-trail users to indicate their intent to cross Peachtree Road. The yield condition at this crossing is satisfactory for automated shuttle operations but may be enhanced with V2I communication. An optional improvement to this crossing includes V2I communication between the RRFB and the automated shuttle.



Example rendering of an intersection with vehicle-to-infrastructure-communication



Additional Considerations Diagram: Green driveways have no operational concerns for the automated shuttle

## 4.3 MARTA (Chamblee Station)

### 4.3.1 Overview

MARTA (Chamblee Station) and vicinity extends from Malone Drive to Pierce Drive. On the western side of Peachtree Road, low-density commercial land use makes up the Malone to Miller Drive block, while high-density, mixed-used development makes up the Miller to Pierce Drive block. Each intersection is stop-controlled and has a raised table, which helps to slow vehicle traffic and simplify crossing movements for pedestrians and bicyclists. At the driveways along the MARTA station area, raised cross-walks also slow

vehicles as they enter and exit Peachtree Road. The Chamblee Station is served by the Gold Line, and has local bus connections to routes 103, 132, 825, and 408. Local bus connections are made at the Chamblee Station bus depot loop that runs parallel to Peachtree Road between Malone and Miller Drive. The bus depot is fenced along the perimeter, thereby limiting access to MARTA's Chamblee Station to entrances at Malone and Miller Drive. Future work associated with the Chamblee Mobility Hub may alter the MARTA access points and create new opportunities for an automated shuttle stop.



MARTA (Chamblee Station) segment overall map with the principal destinations at the station, identified in yellow, and surrounding residential in purple

### 4.3.2 Preferred Stop Location

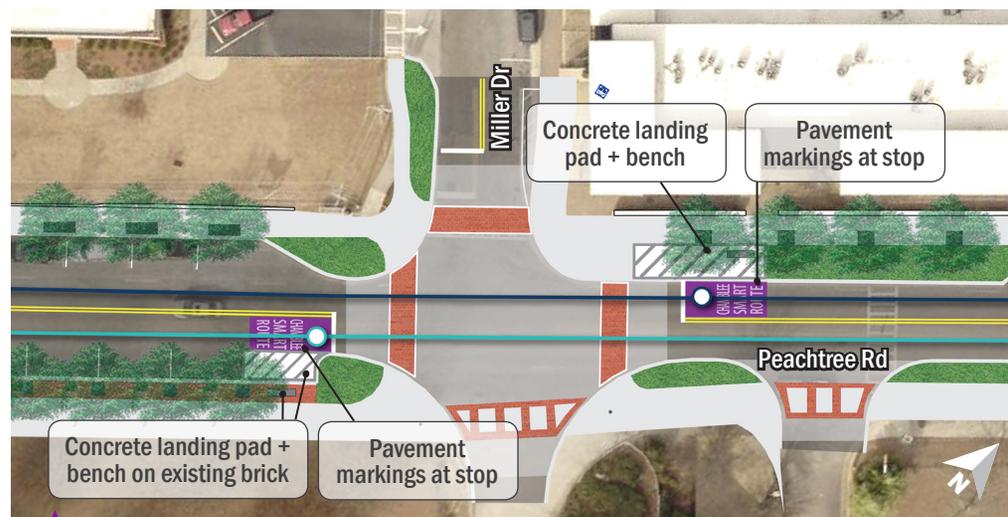
The preferred north and southbound stop locations at Chamblee Station are on the nearside of the Miller Drive intersection. At these locations, travelers have convenient connections to the bus exchange at Chamblee Station, the Gold Line, the rail-trail, and the large-mixed use development at the northern corner of the intersection. The 5300 Lofts mixed-use development at this intersection includes storefronts and residential units that are important automated shuttle demand points and destinations.

The preferred southbound stop location promotes safer pedestrian movements at the Miller Drive intersection but does reduce passenger vehicle sightlines. For vehicles entering the park-and-ride lot from Miller Drive or southbound Peachtree Road, sightlines may be obstructed by a stopped automated shuttle.

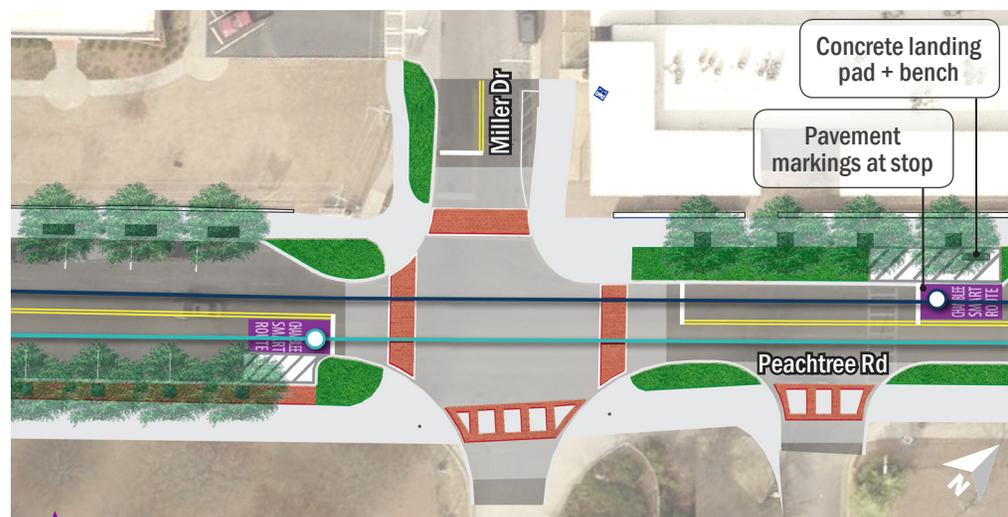
### 4.3.3 Alternate Stop Location

Due to the proximity of the bus depot loop exit driveway and park-and-ride lot entry driveway, an alternate northbound stop is not recommended far-side of the Miller Drive intersection. A stopped automated shuttle at this location has the potential to create queue spillback through the intersection, thereby impacting transit bus operations. Pedestrian facilities are far safer on the near-side than they are on the far-side due to interactions between buses and passenger vehicles at the far-side park-and-ride driveway.

To improve passenger vehicle sightlines, the alternate southbound stop is placed near-side of the park-and-ride lot driveway. The alternate southbound stop also takes advantage of an existing (pre-streetscape work) curb ramp with connection to the sidewalk.



MARTA (Chamblee Station) Preferred Stop Location with modifications



MARTA (Chamblee Station) Alternate Southbound Stop Location with modifications

## 4.3.4 Infrastructure Modifications

### Automated Shuttle Stops

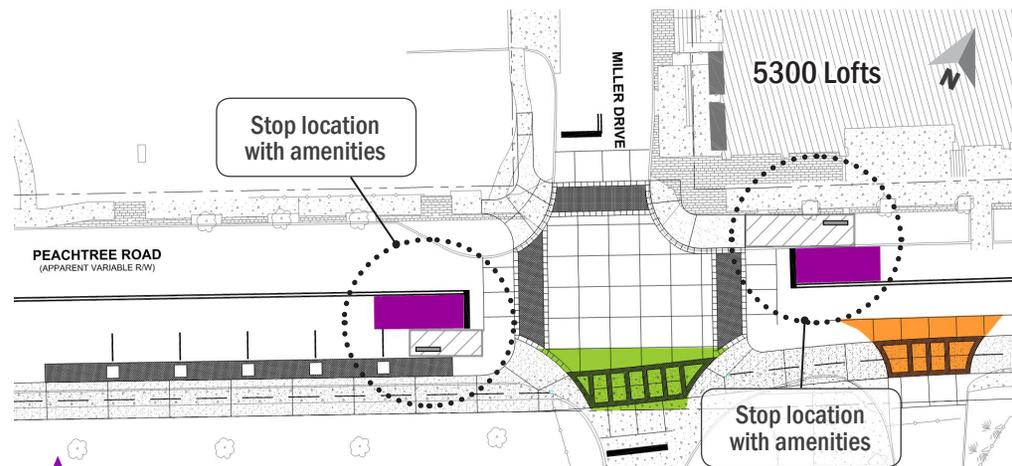
At the proposed stop locations, a concrete landing pad (8 feet wide by 5 feet deep) and sidewalk connection (minimum 4 feet wide) are required for ADA-accessibility. Additional stop amenities, such as pavement delineation paint, a bus stop sign, a bench, and system map are recommended. For the northbound stop, an automated shuttle stop pad and bench will replace one parallel parking space. For the southbound stop, the concrete landing pads and sidewalk connection fit within the existing grass strip.

### Stop-Controlled Intersections

In the MARTA (Chamblee Station) area, all intersections (Miller Drive, Malone Drive, and Pierce Drive) are all-way stop-controlled intersections (per the streetscape plans). The intersections also have a raised table to accommodate pedestrians and further calm traffic. At these intersections, there are no required or recommended infrastructure improvements. Flashing beacon STOP signs and advisory signage are optional safety enhancements.

### Additional Considerations

There are four parking lot driveways in the MARTA (Chamblee Station) area, but none that create operational issues for the automated shuttle. Each driveway has a clear sightline to Peachtree Road and has a raised table pedestrian crossing. The raised table pedestrian crossing adds an element of traffic calming to driveway movements, thereby reducing automated shuttle operational risk. Only one driveway, directly across from the preferred southbound stop, is within the automated shuttle stop influence area. An alternate southbound stop is listed in case the automated shuttle manufacturer determines the sightlines to be obstructed.



Additional Considerations Diagram: Green driveways have no operational concerns for the automated shuttle and orange driveways are of concern and have the potential to impact operations along Peachtree Road

## 4.4 Chamblee Dunwoody Way

### 4.4.1 Overview

Chamblee Dunwoody Way and the surrounding area marks the northern most section of the planned streetscape improvements and begins the transition to the already constructed streetscape improvements. The area begins south of Pierce Drive, which includes the intersection with Chamblee Dunwoody Way, and ends at American Industrial Way. It is landlocked on the eastside by the railroad. On the western side of Peachtree Road is Chamblee’s downtown core, which includes retail storefronts and restaurants. An upscale townhome development, The Bristol, is under construction at the northern corner of Peachtree Road and American Industrial Way. The portion of the development that fronts Peachtree Road includes back-in diagonal parking spaces.



Rendering of The Bristol



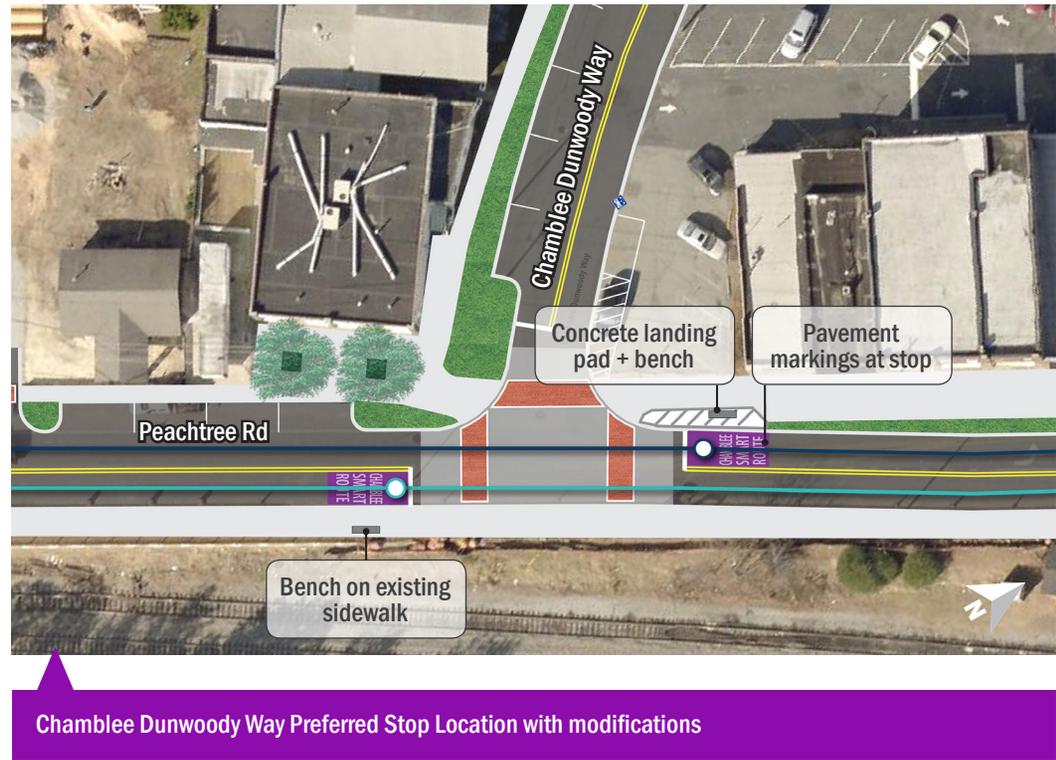
Chamblee Dunwoody segment overall map with the principal destinations of surrounding residential, identified in purple, and the downtown core, in orange

#### 4.4.2 Preferred Stop Location

The preferred stop locations are at Chamblee Dunwoody Way, on the near-side of the raised table intersection. Azalea Place Apartment Homes, 3550 Townsend, Southbound, and The Bristol are important ridership generators in the Chamblee Dunwoody Way area. With an automated shuttle stop within a 3-minute walk (650 feet) of Azalea Place and a 2-minute walk (425 feet) of The Bristol, a critical connection to the MARTA train station and other destinations is provided. Alternate stop locations at American Industrial Way are not recommended at this time.

#### 4.4.3 Alternate Stop Location

During construction of The Bristol, an alternate stop location at American Industrial Way is not recommended. However, following completion, improvements to the intersection of Peachtree Road and American Industrial Way may provide a suitable automated shuttle stop location.



#### 4.4.4 Infrastructure Modifications

##### Automated Shuttle Stops

At the proposed stop locations, a concrete landing pad (8 feet wide by 5 feet deep) and sidewalk connectivity (minimum 4 feet wide) are required for ADA-accessibility. Additional stop amenities, such as pavement delineation paint, a bus stop sign, a bench, and system map are recommended.

##### Peachtree Road / American Industrial Way Intersection

At the intersection of American Industrial Way, additional traffic control is recommended:

- » Right turn only from Norfolk Southern parking lot: Given the size and skew of the intersection, unusual left turning movements from the Norfolk Southern parking lot may create a risky situation that requires evasive action. This modification may require negotiations with the private property owner.

Reconsideration of these infrastructure modifications and others may be warranted after the completion of The Bristol.



Peachtree Road/American Industrial Way intersection with modifications



Plan of The Bristol  
Source: [www.thebristolchamblee.com](http://www.thebristolchamblee.com)

## 4.5 Broad Street

### 4.5.1 Overview

The Broad Street area extends from Chamblee Dunwoody Road to North Peachtree Road. The Broad Street stop primarily serves City Hall, the police station, and retail businesses near the Broad Street intersection. This is also the proposed location of the Chamblee Town Center which will bring substantial amounts of new office, retail, and multi-family housing to the area. With high visibility near City Hall, the automated shuttle will be a prominent showcase of innovation in Chamblee.

The Broad Street stop is also the terminus of the core route. If the option to extend service to Third Rail Studios and Assembly Yards is

not exercised, then infrastructure modifications are recommended for the turn-around maneuver, described below.

The existing cross section of Peachtree Road transitions from 34 feet wide at American Industrial Way to 24 feet wide at City Hall. Lane width, though, is restricted to 12 feet via striping which helps to reduce travel speeds. Future modifications to the Peachtree Road bridge over Chamblee Dunwoody Road warrant additional, future consideration for automated shuttle operations across the bridge. Preliminary concept plans for the Peachtree Road bridge include traffic calming and road diet modifications that improve automated shuttle operations. At 5424 Peachtree Road, a RRFB pedestrian signal also serves as a traffic calming measure.



Broad Street segment overall map with the principle destination at City Hall and surrounding municipal center identified in blue  
NOTE: There are proposed changes to the bridge cross section of Chamblee Dunwoody Road.



Existing condition photo of the RRFB pedestrian signal at 5424 Peachtree Road

### 4.5.2 Preferred Stop Locations

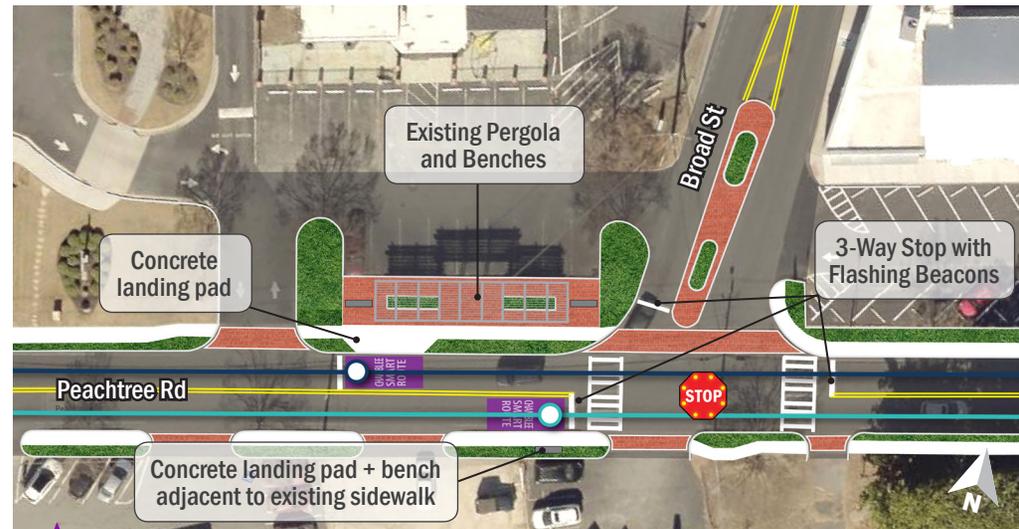
The Broad Street stop serves as an intermediate stop or the route terminus. If the longer route is selected, then the preferred stop locations are both south of the Broad Street intersection. The southbound stop is recommended to be far-side in order to take advantage of an existing patio area near City Hall's front door. The pergola, patio, and adjacent parking area are all City property/right-of-way.

The stop is approximately 50 feet from the intersection, which lessens impact to intersection operations, and provides an additional traffic calming measure for southbound vehicles. The northbound stop is near-side the Broad Street intersection, conveniently located near the City Hall pergola area.

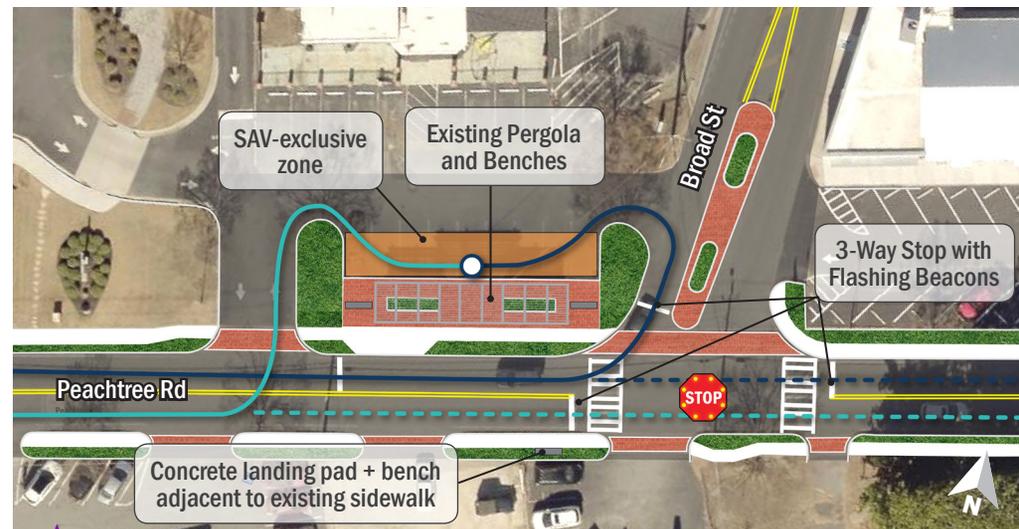
### 4.5.3 Turn-Around Options

If the route terminates at Broad Street, the terminus stop can also take advantage of the existing patio. The parking area adjacent to the patio area has enough space for a safe turnaround, though the back-in, back-out parking poses a risk to automated shuttle operations within the parking lot.

For the Broad Street terminus scenario, the use of parking spaces for an automated shuttle exclusive zone may be impractical. An alternative terminus location would take advantage of the existing landscaped island that is directly adjacent to City Hall. For this option, the automated shuttle would loop the entire island and re-enter Peachtree Road from the City Hall driveway. At this location, Peachtree Road has the right of way. Input from the automated shuttle manufacturer is required to determine whether the automated shuttle can safely enter Peachtree Road without a full-stop controlled intersection.



Broad Street Preferred Stop Location on extended route with modifications



Broad Street Preferred Stop and Turn-Around Location with modifications

## 4.5.4 Infrastructure Modifications

### Automated Shuttle Stops

For the southbound and northbound intermediate stops, a concrete landing pad is required to provide ADA accessibility. Stop appurtenances, such as bus stop signage, route information, and pavement delineation paint are recommended.

### Core Route Terminus

For the preferred route terminus option, no additional stop amenities are recommended. However, advisory signage for the automated shuttle's left-turn into the City Hall parking lot is recommended. To further reduce risk in the parking lot, a designated automated shuttle-exclusive area is recommended.

At the intersection of Broad Street and Peachtree Road, flashing beacon STOP signs are optional safety enhancements to create additional awareness among roadway users.

### Additional Considerations

The automated shuttle route north of American Industrial Way has frequent driveway access points on both sides of Peachtree Road. The driveways may expose the automated shuttle to dangerous crossing movements, particularly where line of sight is reduced. To ensure the automated shuttle can safely identify conflicting movements at these driveways, a line of sight review prior to deployment is recommended. The line of sight review should identify any objects to relocate or vegetation to be trimmed. Automated shuttle advisory signage at driveways is an optional improvement to increase situational awareness.

The speed limit of Peachtree Road north of American Industrial Way is 30-mph, which is slightly above the maximum operating speed for many automated shuttle manufacturers. A 25-mph speed limit along the entire automated shuttle route corridor is recommended.

There is also an opportunity to add V2I communication with the existing RRFB signal south of City Hall. This improvement is an optional safety enhancement.



Additional Considerations Diagram: Green driveways have no operational concerns for automated shuttle

## 4.6 Third Rail Studios (Extension Option 1)

### 4.6.1 Overview

Extension of the route to Third Rail Studios connects this major employment destination and gets in close proximity to the Assembly Yards redevelopment site. This extension nearly doubles the route length by adding 2 miles round-trip to the 2.2-mile core route. From North Peachtree Road to Third Rail Studios, there is a 35-mph speed limit and high frequency of driveways.

### 4.6.2 Preferred Stop Location

The preferred stop location and potential terminus is in the parking lot for Third Rail Studios. Discussions are required with the owner to determine exact location and routing on-site and to discover any redevelopment plans that may impact existing conditions.



Third Rail Studios Preferred Stop and Turn-Around Location with modifications

## 4.6.4 Infrastructure Modifications

### Automated Shuttle Stops

At the proposed stop locations, a concrete landing pad (8 feet wide by 5 feet deep) and sidewalk connection (minimum 4 feet wide) are required for ADA-accessibility. Additional stop amenities, such as pavement delineation paint, a bus stop sign, a bench, and system map are recommended.

### Peachtree Road / Third Rail Studios Intersection

As the automated shuttle leaves the southbound stop at Third Rail Studios, it will make a left turn onto Peachtree Road. To provide for safe operating conditions, an all-way stop is necessary to calm traffic along a straight segment of Peachtree Road that is subject to speeding. Flashing beacon STOP signs are optional safety enhancements. A roundabout is an alternative traffic calming measure that also accommodates automated shuttle operations. However, a roundabout requires significantly more investment in infrastructure modifications, and is more appropriate for a long-term implementation of automated shuttles on Peachtree Road.

### Additional Considerations

South of the all-way stop, the posted speed would need to be reduced to at least 30 mph, and is recommended at 25 mph. The character of Peachtree Road is considerably different on this segment than the core route segment. On this segment, several commercial businesses have broad driveways that serve heavy vehicles. As a heavy vehicle turns and reverses, it utilizes large areas of space and may introduce challenges/risks to an automated shuttle. Spot treatments along the route are recommended to slow traffic and reduce risk of potential collisions.

Proposed improvements to driveway access to Assembly Yards include a new roundabout on Peachtree Road. It is recommended that improvements associated with the development of Assembly Yards consider automated shuttle operations and calm traffic where practical.



Existing conditions photos along Peachtree Road with broad driveways serving heavy vehicles



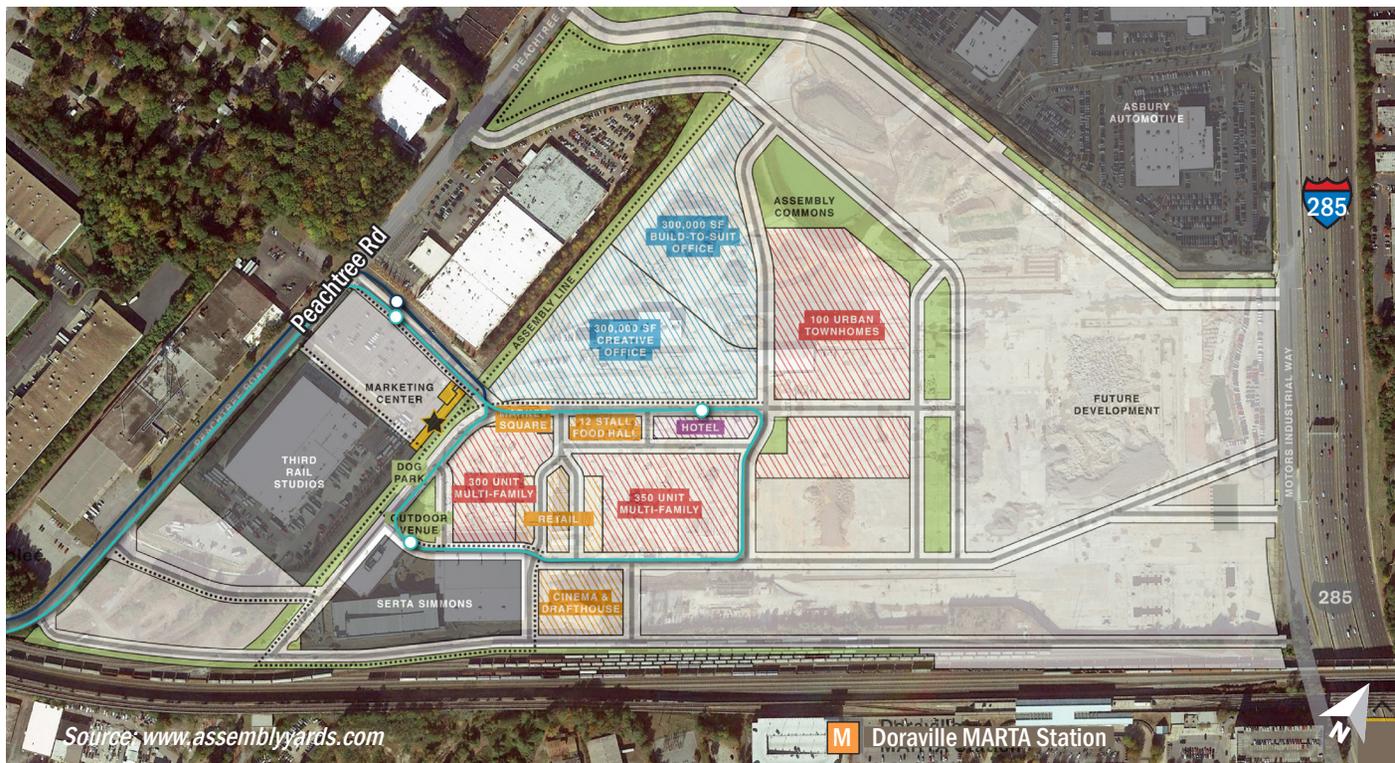
## 4.7 Assembly Yards (Extension Option 2)

### 4.7.1 Overview

Assembly Yards is a large redevelopment site that is anticipated to have 500,000 square feet of commercial and creative space, 120,000 square feet of retail and more than 700 multifamily units. Connecting this new mixed-use site will diversify and strengthen the market for the first/last mile automated shuttle service. Routing will be a factor of timing and development and may change over time to reflect new tenants.

### 4.7.2 Preferred Northern Terminus and Stop Locations

The initial route is anticipated to stop at the new Serta Simmons Headquarters, Third Rail Studios, and the new residential buildings. There is potential for the route to extend further northeast towards 285, in order to connect to the Doraville MARTA station. Discussions with the owner are required prior to implementing this route extension to ensure compatibility with the site's own planned automated shuttle route and operations.



Assembly Yards Preferred Stop and Turn-Around Location with modifications

Source: [www.assemblyyards.com](http://www.assemblyyards.com)



# **CHAPTER 5**

## **Vehicle Secure Storage & Charging**

## 5.0 Vehicle Secure Storage & Charging

A secure storage space with charging capabilities is required. The primary purpose of vehicle storage is to provide a secure and climate-controlled space where the automated shuttle can be charged, cleaned, and where light maintenance can be performed.

### 5.0.1 Secure Storage

**Minimum standards for automated shuttle storage include the following:**

- » Located on or within 650 feet of the automated shuttle route
- » Enclosed, climate-controlled (40 – 95 degrees F)
- » 10 ft tall x 10 ft wide x 18 ft long
- » Tools and spare part storage
- » Power for charging

A nearby yard hydrant is ideal to facilitate regular cleaning to maintain the appearance of the automated shuttle.

### 5.0.2 Charging

The storage site also serves as the charging location. Since charging requires several hours, recharging is best suited in a secure and climate-controlled environment. Depending on the vehicle manufacturer, charging infrastructure requirements vary. However, for the quickest charge, a Type 1 Charging Station or NEMA 14-50R outlet is recommended.

If existing facilities are unavailable or do not meet the minimum storage standards above, there are affordable alternatives. Many off-the-shelf building kits can be easily repurposed as secure storage for the automated shuttle. These units can be built on-site with little additional infrastructure investment.

### 5.0.3 Solar Array & Battery Storage

A solar array and battery storage system is an optional system enhancement and would provide for greater potential for life-cycle electricity and emission savings.



Example photo of an off-the-shelf building kit to potentially be repurposed as a secure storage option for the automated shuttle

## 5.1 Potential Storage & Charging Locations

### 5.1.1 Option 1 – Behind Police Station (preferred)

The recommended secure storage location is in the parking lot adjacent the Chamblee Police Station. Benefits of this location include proximity to the core route, security, and existing infrastructure. The Chamblee Police Station already serves as a vehicle storage location for police cars, so existing infrastructure, such as garage space, yard hydrant, and tool storage, may be readily available already. “In-house” coordination among city departments may also be simpler than a partnership with a private party.



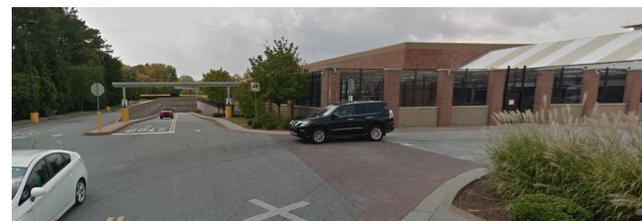
### 5.1.2 Option 2 – MARTA – Chamblee Station

Directly on the core route is the MARTA – Chamblee Station park-and-ride lot. The periphery of this lot offers a secure and convenient location to store the automated shuttle. However, coordination with and permission from MARTA and infrastructure modifications (power outlet and an enclosed structure) are needed.



### 5.1.3 Option 3 – Parking Garage at Chamblee Village or the Oliver

Off Chamblee Tucker Road, and just west of the park-and-ride lot, the Chamblee Village retail center or the Oliver parking garage is a secure area that can accommodate storage amenities. The location is more than 500 feet from the core route but offers the potential for route expansion in an active, mixed-use block. Like the other options (apart from the police station location), coordination with private parties is necessary to determine the viability of this option.



### 5.1.4 Option 4 – Third Rail and Assembly Yards

The route extension option creates opportunity to implement a more permanent and intentional secure storage facility. With the support of Third Rail and Assembly Yards, secure storage that meets the minimum requirements may be incorporated into future development.

Potential storage and charging location imagery for options 1-3, in descending order



# **CHAPTER 6**

## Operations

## 6.0 Operations

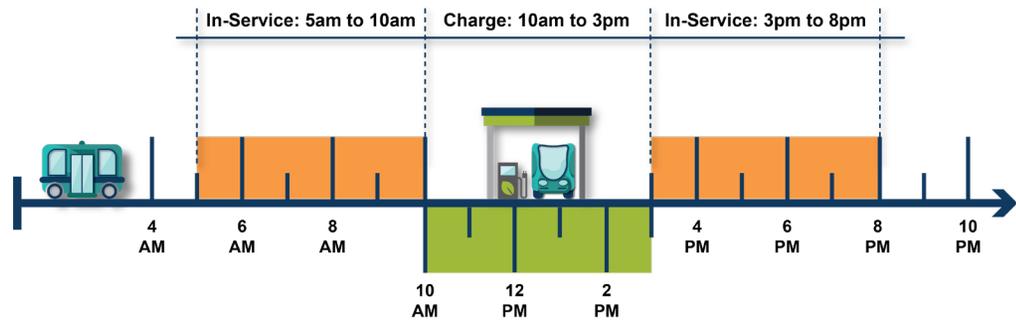
Automated shuttle operations can come in many different forms, depending on the service type and user-profile groups targeted. For instance, the automated shuttle may focus on first/last-mile connection to and from the MARTA - Chamblee Station. Alternatively, the automated shuttle service may be structured for leisure use that connects users to retail, entertainment, and dining along Peachtree Road. Regardless, the service profile is constrained by the automated shuttle’s battery life, fleet size, and charging requirements.

The service profiles presented assume a 1-vehicle fleet. On average, the battery life of a automated shuttle is between 9 and 15 hours, depending on the manufacturer and energy demands. Battery life is most significantly impacted by steep grades and air conditioning needs. In Chamblee, air conditioning will test the limits of the battery life during summer months. A 2-vehicle fleet would allow for near continuous operation (20 continuous hours per day) if shuttles are run successively. Alternatively, shuttles may be run simultaneously, which reduces the headway by 50% without any changes to the service profile. A second shuttle also provides critical redundancy to the shuttle service by limiting service blackouts related to unforeseen maintenance.

The service profiles below have a maximum 10-hour service day, in order to conservatively plan for the hottest summer days. The automated shuttle can run 7-days/week, with any combination of the below service profiles.

### 6.0.1 Service 1 – Commuter / Last Mile Automated Shuttle Service

The commuter / last mile automated shuttle service is focused on the morning and evening commuter, particularly those that live along Peachtree Road and use the MARTA Gold Line. The service runs for five hours during the morning (5-10 AM) and evening peak (3-8 PM), providing a mid-day break for charging.



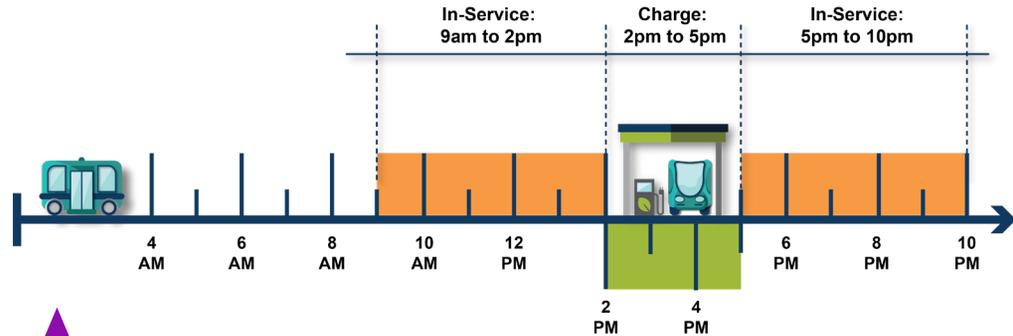
Service Option 1 Diagram - Commuter/Last Mile Automated Shuttle Service

#### Example Northbound Time Table - Commuter Shuttle Service

Peachtree Station	Mercy Park	MARTA	Chamblee - Dunwoody	Broad
5:00 AM	5:01 AM	5:03 AM	5:05 AM	5:07 AM
5:14 AM	5:16 AM	5:18 AM	5:20 AM	5:22 AM
5:29 AM	5:31 AM	5:33 AM	5:35 AM	5:37 AM
5:44 AM	5:46 AM	5:48 AM	5:50 AM	5:52 AM

### 6.0.2 Service 2 – Leisure / Entertainment Automated Shuttle Service

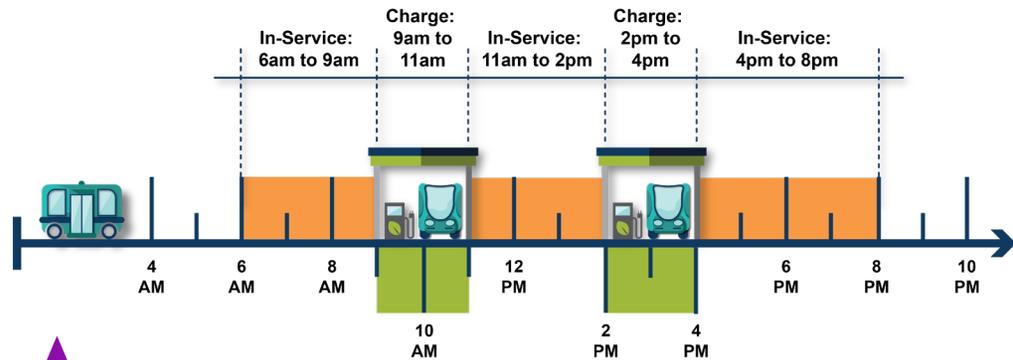
The leisure / entertainment automated shuttle service creates a convenient service for the mid-day (9-2 PM) and evening trips (5-10 PM) that are mostly characterized by shopping, entertainment, and dining activities. During the day, there is also time for the automated shuttle to recharge before the service day and from 2-5 PM.



Service Option 2 Diagram - Leisure/Entertainment Automated Shuttle Service

### 6.0.3 Service 3 – Hybrid Automated Shuttle Service

The hybrid automated shuttle service serves the three main travel peaks of the day to capture morning and evening commuters and mid-day and evening leisure trips. The automated shuttle runs from 6-9 AM, 11-2 PM, and 4-8 PM. Charging time is split into two separate time periods: 9-11 AM and 2-4 PM.



Service Option 3 Diagram - Hybrid Automated Shuttle Service

Regardless of the service profile, the anticipated operating profile has a 15-minute headway at an average speed of 12 mph with 30-second dwell times.

## 6.1 Cost Estimate

To implement the automated shuttle core route, certain infrastructure, capital, and operational costs will be incurred.

### 6.1.1 Infrastructure

The infrastructure requirements for an automated shuttle are minimal, particularly compared to other transit modes. The infrastructure costs are primarily a function of the number of automated shuttle stops and the character of the route. The ongoing Peachtree Road streetscape improvements create a very automated shuttle-friendly environment. Infrastructure recommendations are related to stop appurtenances, such as concrete landing pads, benches, and trash cans. Also, along the route are several stop-controlled intersections and one signalized intersection. At these locations, additional advisory signage and V2I infrastructure are recommended. Another cost consideration is the secure, climate-controlled storage for the automated shuttle.



### 6.1.2 Vehicles

The primary component of the capital cost for this service is the vehicle itself. An automated shuttle can either be procured through an outright purchase or a lease. The cost of automated shuttles range between \$225,000 and \$400,000, while the option to lease varies depending on the manufacturer and the length of the lease. Leasing ranges from \$120,000 - \$420,000 / year.



### 6.1.3 Operations

The operational cost varies between the full-purchase and multi-year lease option. In the multi-year lease option, several operational costs are included (e.g., licensing fees, insurance, maintenance).

Start-up costs include shipping, staff training, and site commissioning. The staff training provides the operator with the necessary knowledge and skills to operate the automated shuttle, while the site commissioning includes route mapping and final route analysis. One-time start-up costs are estimated at approximately \$35,000.

Also included in the operational cost estimate is an onboard attendant. Though the automated shuttles may operate autonomously, some owners, risk managers, and/or governing bodies require onboard attendants. In this case, the cost of an onboard attendant is included. Once regulation is adapted and/or comfort for automated vehicles amongst stakeholders is met, then the true cost-effectiveness of automated shuttles can be achieved.



Purchase Option									
		Quantity			Unit	Unit Price	Total		
		Year 1 Core Route	Year 1 Extension	Year 2			Year 1 Core Route	Year 1 Extension	Year 2
<b>Infrastructure</b>									
<b>Required Infrastructure</b>									
	Connected Traffic Signal	1			EA	\$10,000	\$10,000		
	Concrete Landing Pad (4" Thick)	44.4	17.8		SY	\$42	\$1,867	\$747	
	Secure Storage	1			EA	\$50,000	\$50,000		
<b>Recommended Infrastructure</b>									
	Advisory Signs	14	9		EA	\$500	\$7,000	\$4,500	
	Painting - Lane Symbol	12	4		EA	\$150	\$1,800	\$600	
	Bench	5	2		EA	\$1,500	\$7,500	\$3,000	
	Trash Can	5	2		EA	\$2,000	\$10,000	\$4,000	
<b>Optional Infrastructure</b>									
	Flashing Beacons	6	3		EA	\$5,000	\$30,000	\$15,000	
	Solar Panel Array	10,000			WATT	\$2.50	\$25,000		
	Painting - Lane Striping		1,000		LF	\$7.00		\$7,000	
	Contingency						\$25,000	\$6,000	
<b>SUBTOTAL</b>							<b>\$168,167</b>	<b>\$40,847</b>	<b>\$0</b>
<b>Fleet</b>									
	Automated Shuttle Purchase	1			EA	\$350,000	\$350,000		
<b>SUBTOTAL</b>							<b>\$350,000</b>	<b>\$0</b>	<b>\$0</b>
<b>Operational</b>									
	Start-Up Costs	1			EA	\$75,000	\$75,000		
	Operations	1		1	YEAR	\$300,000	\$300,000		\$300,000
	Software Licensing	1		1	YEAR	\$40,000	\$40,000		\$40,000
	Insurance	1		1	YEAR	\$10,000	\$10,000		\$10,000
	Electricity	1		1	YEAR	\$1,000	\$1,000		\$1,000
	Maintenance	1		1	YEAR	\$50,000	\$50,000		\$50,000
<b>SUBTOTAL</b>							<b>\$476,000</b>	<b>\$0</b>	<b>\$401,000</b>
<b>TOTAL</b>							<b>\$994,167</b>	<b>\$40,847</b>	<b>\$401,000</b>
<b>GRAND TOTAL</b>							<b>\$1,436,014</b>		

Lease Option									
		Quantity			Unit	Unit Price	Total		
		Year 1 Core Route	Year 1 Extension	Year 2			Year 1 Core Route	Year 1 Extension	Year 2
<b>Infrastructure</b>									
<b>Required Infrastructure</b>									
	Connected Traffic Signal	1			EA	\$10,000	\$10,000		
	Concrete Landing Pad (4" Thick)	44.4	17.8		SY	\$42	\$1,867	\$747	
	Secure Storage	1			EA	\$50,000	\$50,000		
<b>Recommended Infrastructure</b>									
	Advisory Signs	14	9		EA	\$500	\$7,000	\$4,500	
	Painting - Lane Symbol	12	4		EA	\$150	\$1,800	\$600	
	Bench	5	2		EA	\$1,500	\$7,500	\$3,000	
	Trash Can	5	2		EA	\$2,000	\$10,000	\$4,000	
<b>Optional Infrastructure</b>									
	Flashing Beacons	6	3		EA	\$5,000	\$30,000	\$15,000	
	Solar Panel Array	10,000			WATT	\$2.50	\$25,000		
	Painting - Lane Striping		1,000		LF	\$7.00		\$7,000	
	Contingency						\$25,000	\$6,000	
<b>SUBTOTAL</b>							<b>\$168,167</b>	<b>\$40,847</b>	<b>\$0</b>
<b>Fleet</b>									
	Automated Shuttle Lease - 3 year	1			YEAR	\$180,000	\$180,000		\$180,000
<b>SUBTOTAL</b>							<b>\$180,000</b>	<b>\$0</b>	<b>\$180,000</b>
<b>Operational</b>									
	Start-Up Costs	1			EA	\$75,000	\$75,000		
	Operations	1			YEAR	\$300,000	\$300,000		\$300,000
	Electricity	1			YEAR	\$1,000	\$1,000		\$1,000
<b>SUBTOTAL</b>							<b>\$376,000</b>	<b>\$0</b>	<b>\$301,000</b>
<b>TOTAL</b>							<b>\$724,167</b>	<b>\$40,847</b>	<b>\$481,000</b>
<b>GRAND TOTAL</b>							<b>\$1,246,014</b>		

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# **CHAPTER 7**

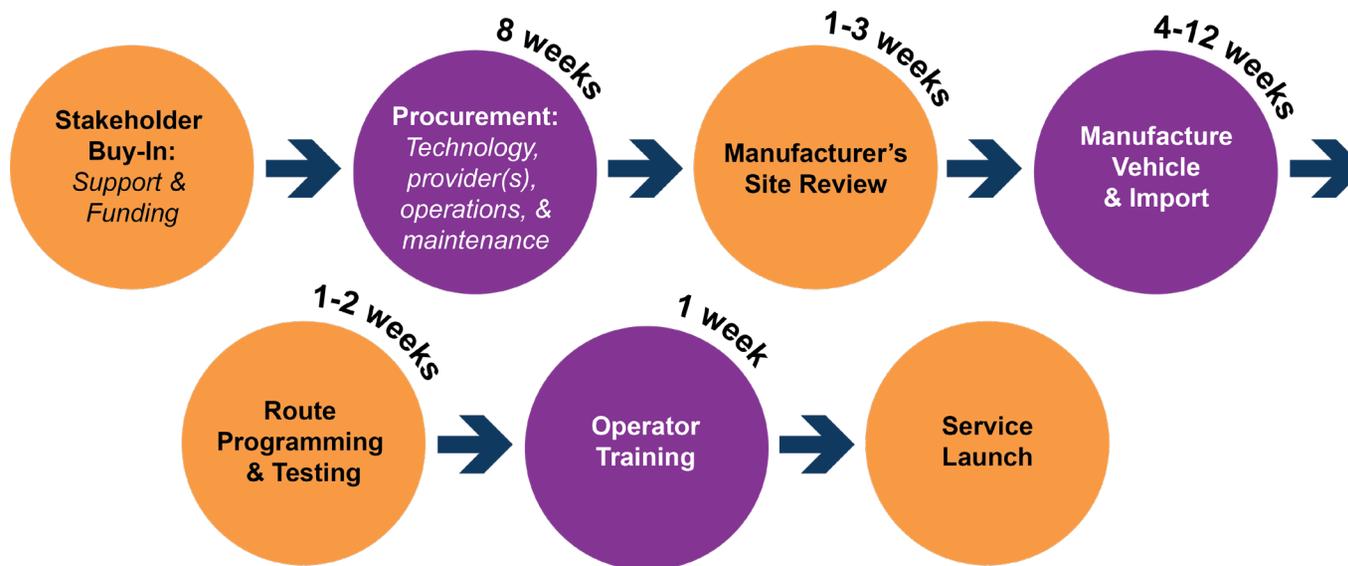
Deployment Timeline/  
Next Steps

## 7.0 Deployment Timeline/ Next Steps

Once stakeholder support and funding is secured, the deployment timeline is estimated between 4 and 6 months.

**The deployment timeline includes several key steps:**

- » Procurement: At a minimum, the vehicle and complementary technology, such as fleet management and the customer facing app, must be procured. Operations and maintenance may also need to be procured.
- » Manufacturer's site review: During the procurement process a site visit to the manufacturing plant may be warranted if the assembly line is new and not proven.
- » Vehicle manufacturing and import: If the vehicle is manufactured outside the country, it must be imported and may require an exemption if it does not conform to US standards.
- » Route programming and testing: The route must be mapped by the vehicle to create a baseline 3D map. Several test runs will be performed including testing of any related software and hardware (connected signals).
- » Operator training: If not already completed, operators of the vehicles will undergo training prior to operating the vehicle while carrying passengers.



Automated vehicle technology is changing rapidly and new applications and pilots of automated vehicle technology are put on display each year. Already, there have been a handful of automated shuttle pilots on public rights-of-way, with many more in the planning stages.

**In the U.S., the following public agencies have implemented automated shuttle pilots:**

- » City of Las Vegas (Las Vegas, NV)
- » Contra Costa Transportation Authority (San Roman, CA)
- » City of Arlington (Entertainment District, Arlington, TX)
- » Smart Columbus (Columbus, OH)
- » City of Bryan (Bryan, TX)
- » City of Detroit (Detroit, MI)
- » Jacksonville Transport Authority (Jacksonville, FL)



Photo from Las Vegas pilot



Photo from Columbus pilot

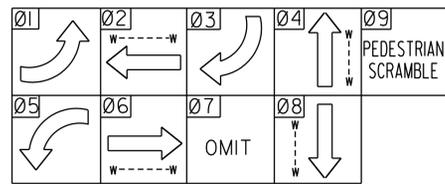


# **APPENDIX A**

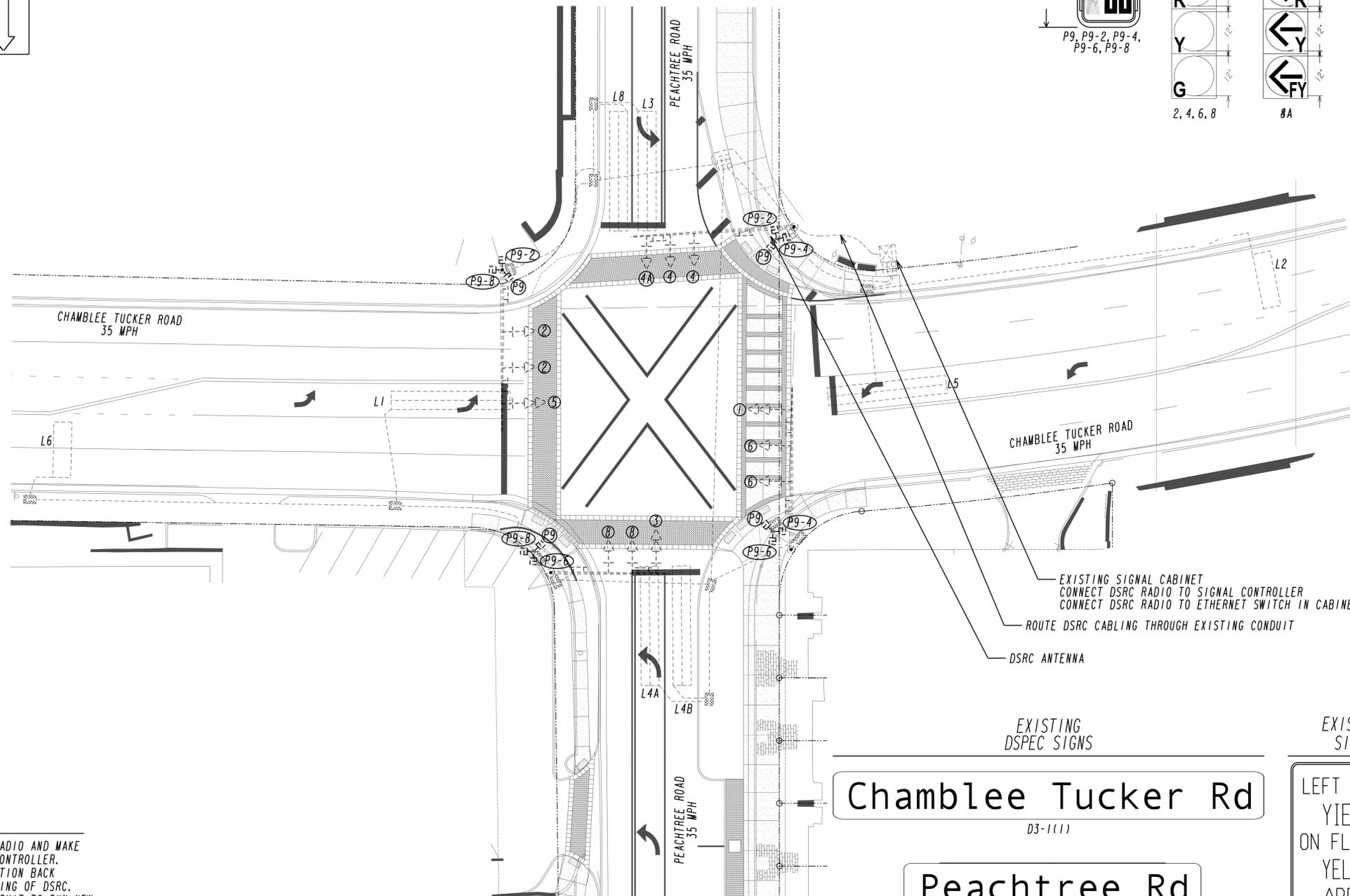
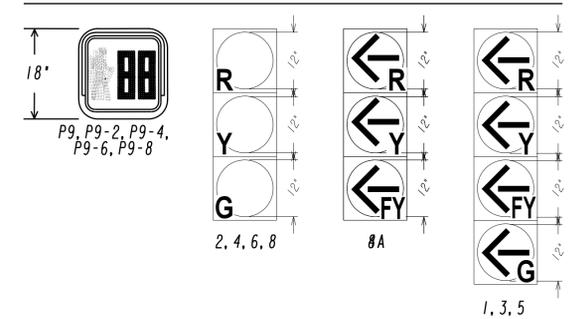
**Chamblee-Tucker  
and Peachtree Road  
Intersection - Signal  
Concept Plan**



PHASING DIAGRAM



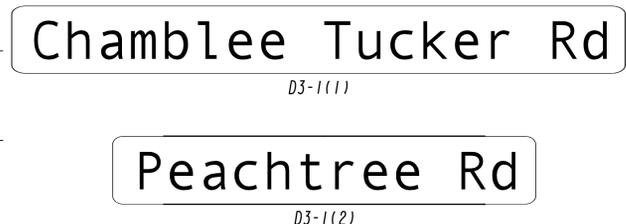
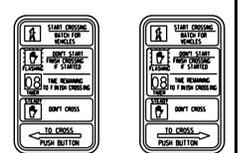
EXISTING LED SIGNAL HEADS  
W/REFLECTIVE BACKPLATES



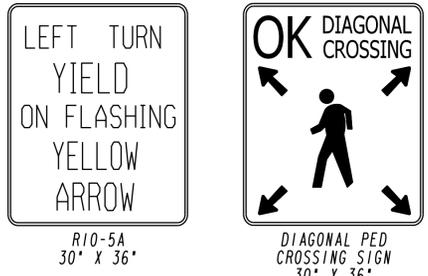
NOTE:

CONTRACTOR SHALL INSTALL NEW DSRC RADIO AND MAKE CONNECTION TO THE EXISTING SIGNAL CONTROLLER. CONTRACTOR SHALL ALSO ENSURE CONNECTION BACK TO CENTRAL FOR CONTROL AND PROGRAMMING OF DSRC. CONTRACTOR MAY USE THE EXISTING CONDUIT TO RUN NEW WIRING FROM EXISTING SIGNAL POLES TO THE TRAFFIC SIGNAL CABINET IF SUFFICIENT SPACE IS AVAILABLE WITHIN THE CONDUIT AND THE EXISTING CONDUIT IS FREE AND CLEAR OF DAMAGE AND DEBRIS.

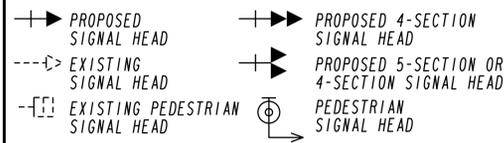
EXISTING PEDESTRIAN SIGNS



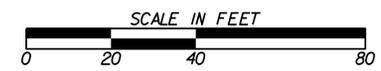
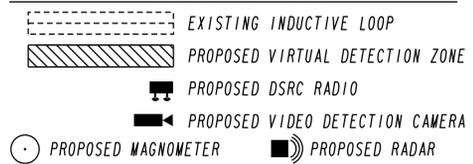
EXISTING SIGNS



SIGNAL LEGEND



DETECTOR LEGEND



REVISION DATES

NO.	DATE	DESCRIPTION

STATE OF GEORGIA  
DEPARTMENT OF TRANSPORTATION

OFFICE:  
**SIGNAL PLANS**  
CONCEPT SIGNAL PLAN  
CHAMBLEE-TUCKER ROAD  
AT PEACHTREE ROAD  
FULTON COUNTY

DRAWING No.  
**27-001**

