ATLANTA-REGION TRANSIT LINK AUTHORITY

ATL Regional Technology Committee

April 25, 2019

HOW PUBLIC TRANSIT TIPS THE SCALES IN THE AUTOMATED VEHICLE FUTURE

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CREATING THE NEXT®


DELTA
20
Augusta
Birmingham
Fulton St
Central Ave
Downtown

What do we do?

Let’s start by defining the problem.

10 Leading Causes of Death by Age Group, United States – 2014

	Age Groups										
Rank	<1	1-4	5-9	10-14	15-24	25-34	35-44	45-54	55-64	65+	Total
1	Congenital Anomalies 4,746	Unintentional Injury 1,216	Unintentional Injury 730	Unintentional Injury 750	Unintentional Injury 11,836	Unintentional Injury 17,357	Unintentional Injury 16,048	Malignant Neoplasms 44,834	Malignant Neoplasms 115,282	Heart Disease 489,722	Heart Disease 614,348
2	Short Gestation 4,173	Congenital Anomalies 399	Malignant Neoplasms 436	Suicide 425	Suicide 5,079	Suicide 6,569	Malignant Neoplasms 11,267	Heart Disease 34,791	Heart Disease 74,473	Malignant Neoplasms 413,885	Malignant Neoplasms 591,699
3	Maternal Pregnancy Comp. 1,574	Homicide 364	Congenital Anomalies 192	Malignant Neoplasms 416	Homicide 4,144	Homicide 4,159	Heart Disease 10,368	Unintentional Injury 20,610	Unintentional Injury 18,030	Chronic Low. Respiratory Disease 124,693	Chronic Low. Respiratory Disease 147,101
4	SIDS 1,545	Malignant Neoplasms 321	Homicide 123	Congenital Anomalies 156	Malignant Neoplasms 1,569	Malignant Neoplasms 3,624	Suicide 6,706	Suicide 8,767	Chronic Low. Respiratory Disease 16,492	Cerebro-vascular 113,308	Unintentional Injury 136,053
5	Unintentional Injury 1,161	Heart Disease 149	Heart Disease 69	Homicide 156	Heart Disease 953	Heart Disease 3,341	Homicide 2,588	Liver Disease 8,627	Diabetes Mellitus 13,342	Alzheimer's Disease 92,604	Cerebro-vascular 133,103
6	Placenta Cord. Membranes 965	Influenza & Pneumonia 109	Chronic Low. Respiratory Disease 68	Heart Disease 122	Congenital Anomalies 377	Liver Disease 725	Liver Disease 2,582	Diabetes Mellitus 6,062	Liver Disease 12,792	Diabetes Mellitus 54,161	Alzheimer's Disease 93,541
7	Bacterial Sepsis 544	Chronic Low Respiratory Disease 53	Influenza & Pneumonia 57	Chronic Low Respiratory Disease 71	Influenza & Pneumonia 199	Diabetes Mellitus 709	Diabetes Mellitus 1,999	Cerebro-vascular 5,349	Cerebro-vascular 11,727	Unintentional Injury 48,295	Diabetes Mellitus 76,488
8	Respiratory Distress 460	Septicemia 53	Cerebro-vascular 45	Cerebro-vascular 43	Diabetes Mellitus 181	HIV 583	Cerebro-vascular 1,745	Chronic Low. Respiratory Disease 4,402	Suicide 7,527	Influenza & Pneumonia 44,836	Influenza & Pneumonia 55,227
9	Circulatory System Disease 444	Benign Neoplasms 38	Benign Neoplasms 36	Influenza & Pneumonia 41	Chronic Low Respiratory Disease 178	Cerebro-vascular 579	HIV 1,174	Influenza & Pneumonia 2,731	Septicemia 5,709	Nephritis 39,957	Nephritis 48,146
10	Neonatal Hemorrhage 441	Perinatal Period 38	Septicemia 33	Benign Neoplasms 38	Cerebro-vascular 177	Influenza & Pneumonia 549	Influenza & Pneumonia 1,125	Septicemia 2,514	Influenza & Pneumonia 5,390	Septicemia 29,124	Suicide 42,773

Data Source: National Vital Statistics System, National Center for Health Statistics, CDC.
Produced by: National Center for Injury Prevention and Control, CDC using WISQARS™.

Centers for Disease Control and Prevention
National Center for Injury Prevention and Control

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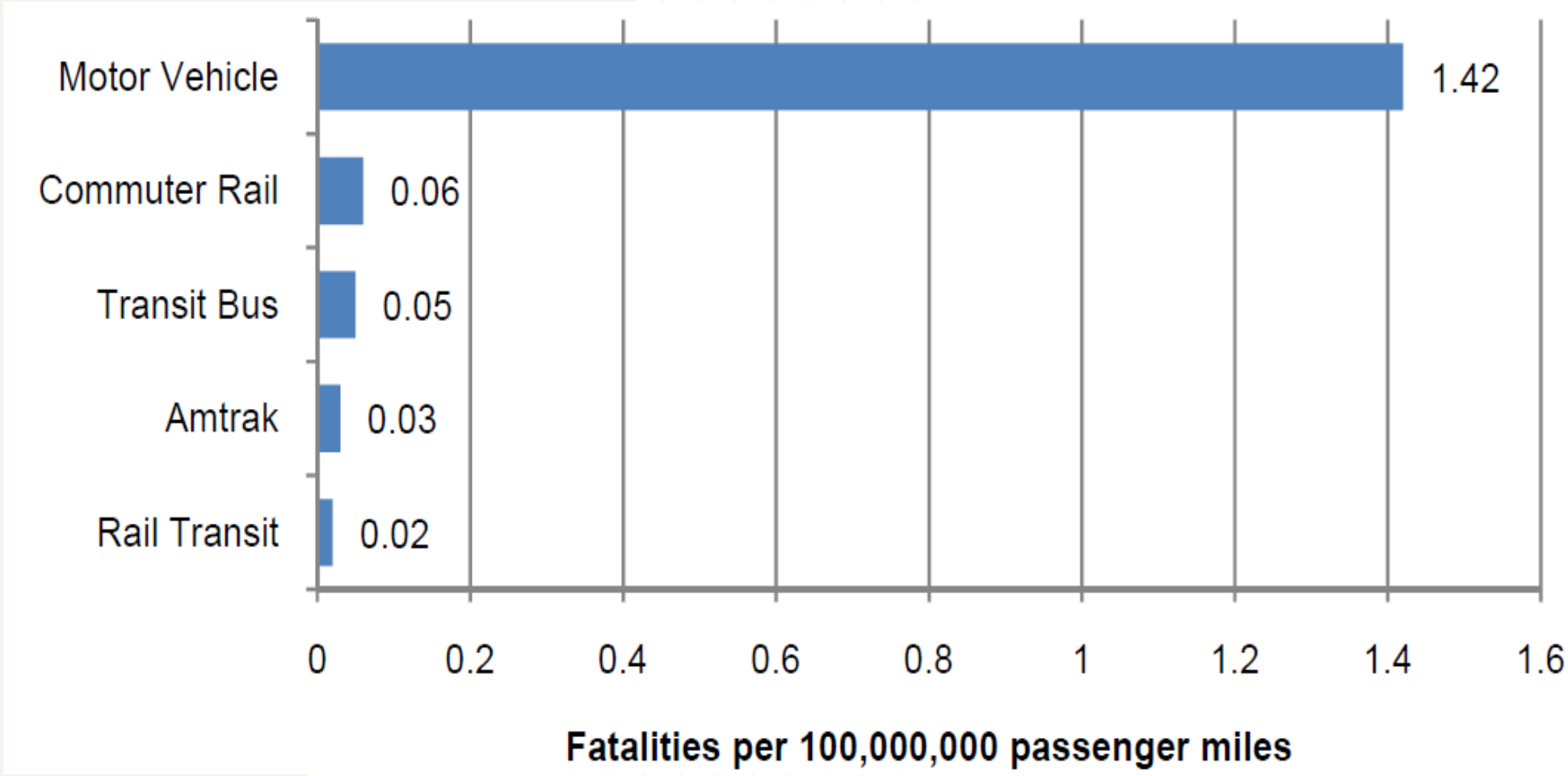
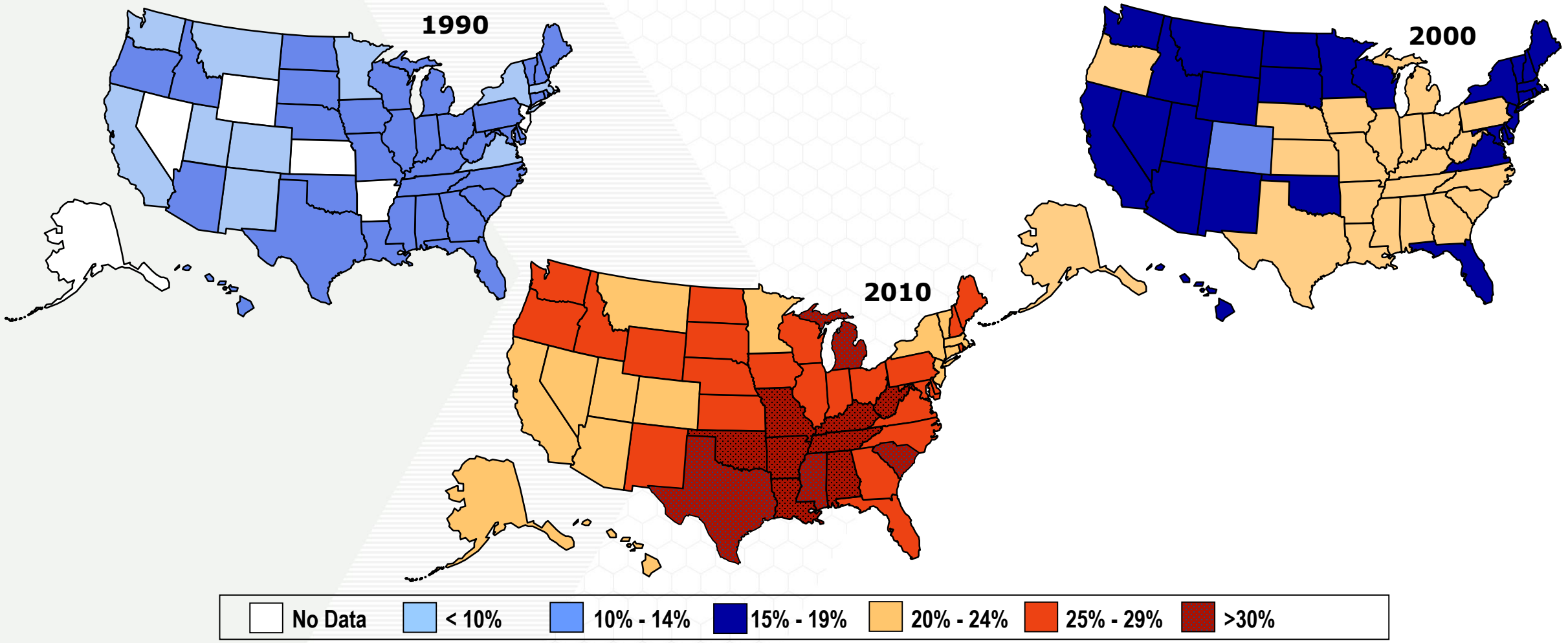
Safety



Source: APTA, 2011, Public Transportation Fact Book

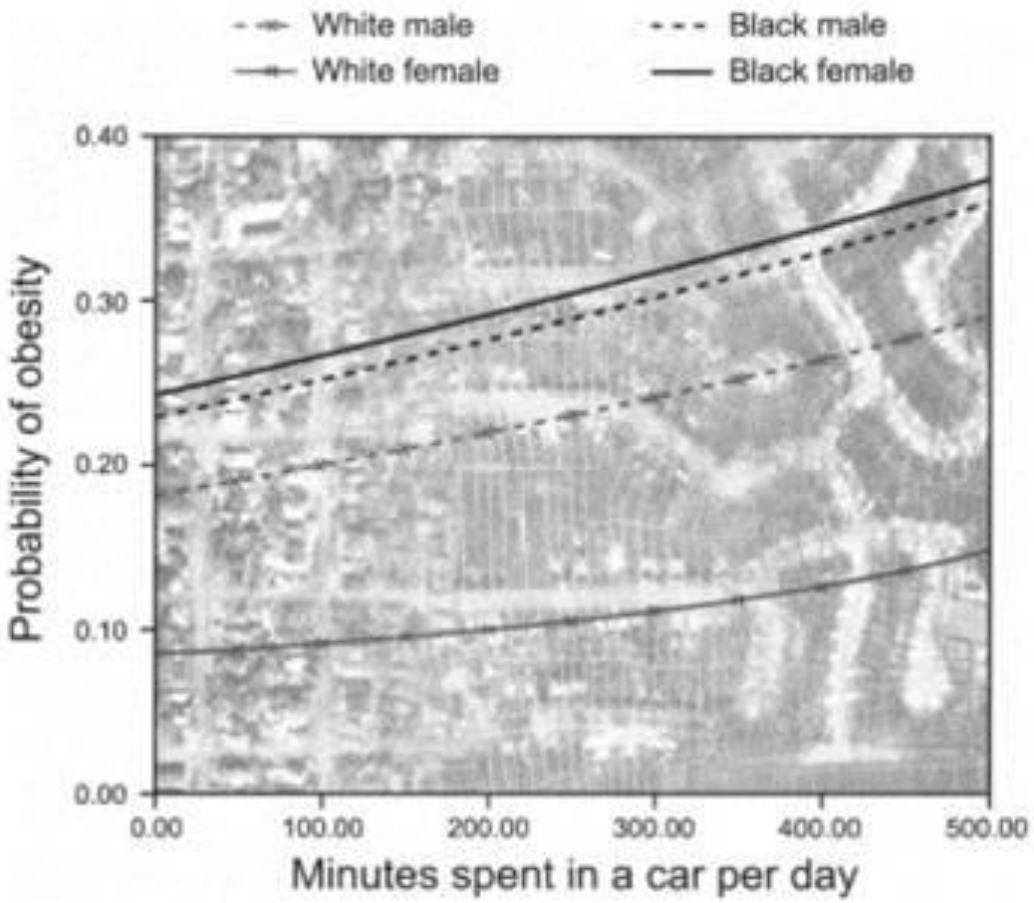
Obesity

(*BMI ≥30, or about 30 lbs. overweight for 5’4” person)



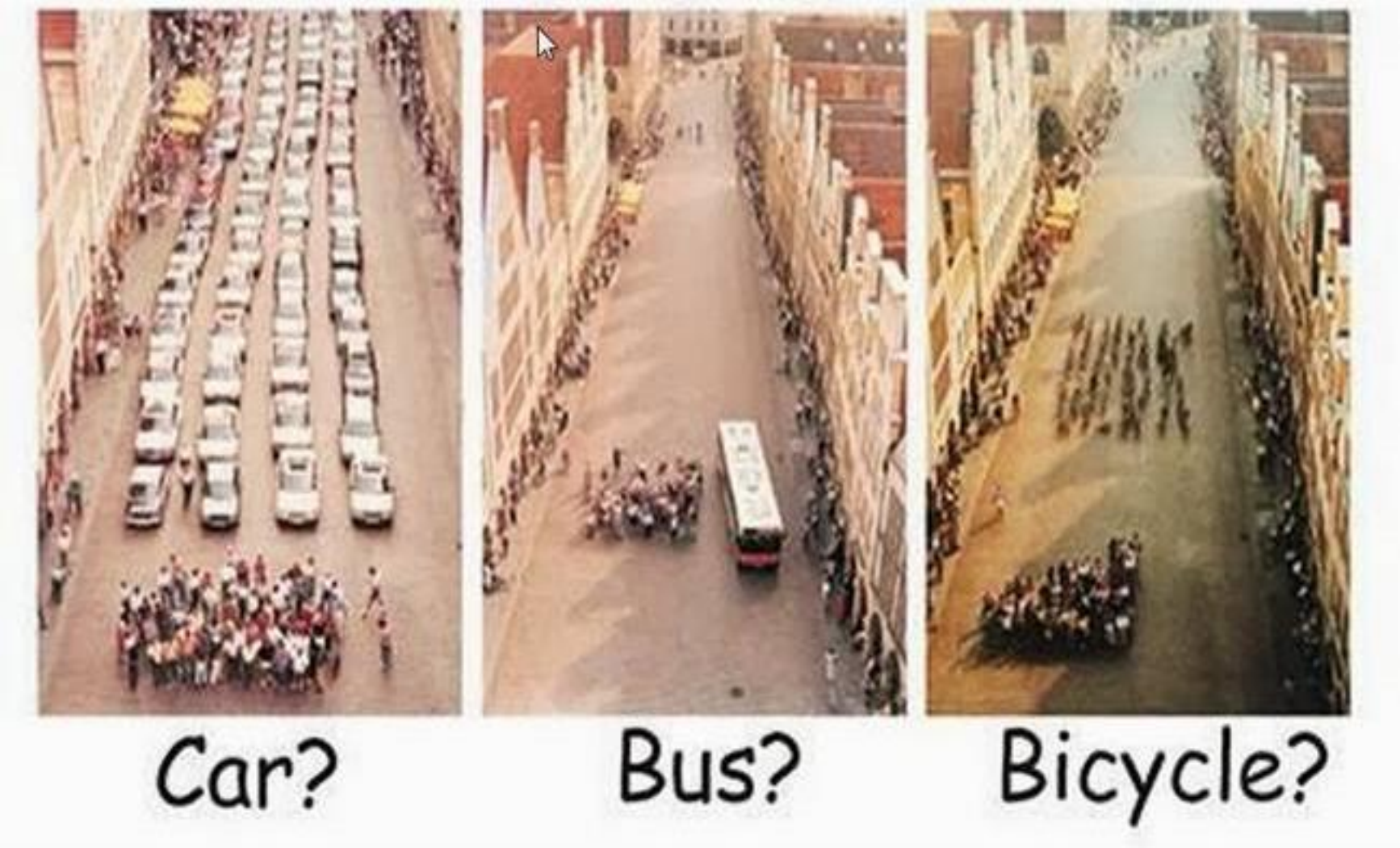
Centers for Disease Control and Prevention, 2011

The risk of obesity increases 6% with every additional hour spent per day commuting in a car



Frank, L., Andresen, M. & Schmid, T. (2004). Obesity Relationships with Community Design, Physical Activity and Time Spent in Cars. *American Journal of Preventative Medicine 27*(2).

Space



When I say “**Future of Transportation**”, what do you think of?

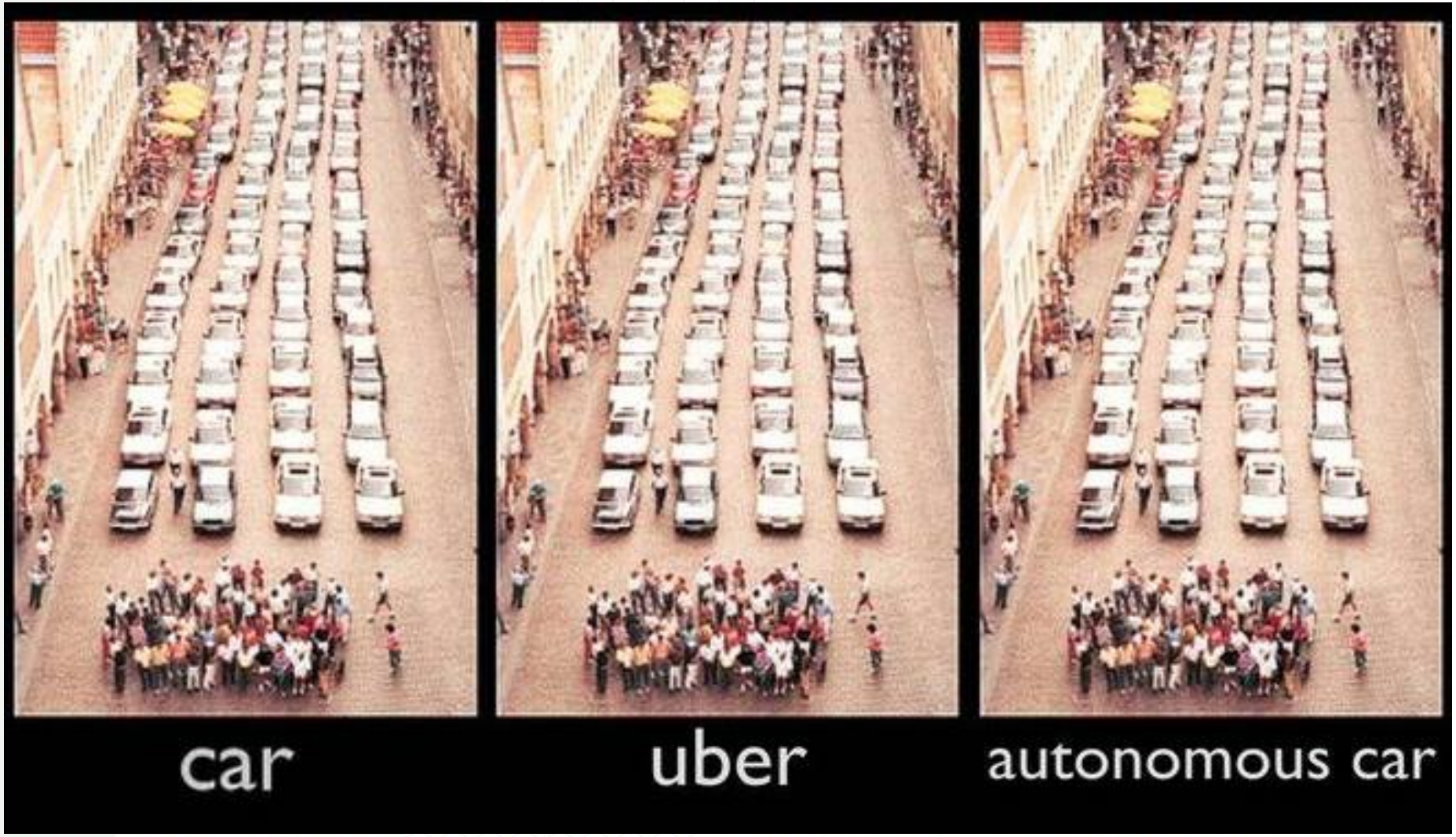
How do you think we are planning to get around in 20 years?

Solutions:

Self-driving cars

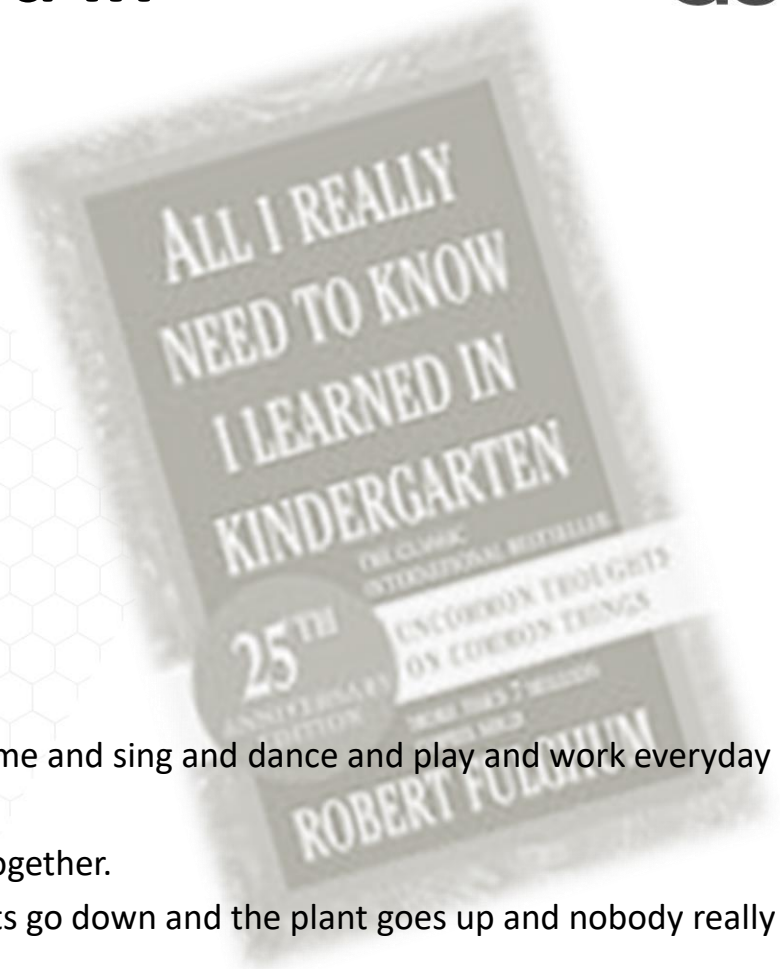
TNC's (Uber and Lyft)

Future of Transport



How can we ensure a livable and effective future transportation system?

All I really need to know I learned in Kindergarten



1. Share everything.
2. Play fair.
3. Don't hit people.
4. Put things back where you found them.
5. CLEAN UP YOUR OWN MESS.
6. Don't take things that aren't yours.
7. Say you're SORRY when you HURT somebody.
8. Wash your hands before you eat.
9. Flush.
10. Warm cookies and cold milk are good for you.
11. Live a balanced life - learn some and drink some and draw some and paint some and sing and dance and play and work everyday some.
12. Take a nap every afternoon.
13. When you go out into the world, watch out for traffic, hold hands, and stick together.
14. Be aware of wonder. Remember the little seed in the Styrofoam cup: The roots go down and the plant goes up and nobody really knows how or why, but we are all like that.
15. Goldfish and hamster and white mice and even the little seed in the Styrofoam cup - they all die. So do we.
16. And then remember the Dick-and-Jane books and the first word you learned - the biggest word of all – LOOK.

Possible Autonomous Futures

1. Personal autonomous vehicle ownership
   - Typical driver only able to afford one vehicle - sized to maximize usefulness
   - Zero-occupant trips

2. Single occupant ride-hailing
   - Circling to wait for pick-ups
   - Passengerless delivery trips
   - Increased travel demand

     Dinner in Chattanooga?

3. Shared usage of mobility services

Future of Public Transport

1. If travel is a utility, then mobility must be a service
2. Spatial priority must be given to collective transportation modes
3. Focus first on service, then on technology
4. “Scientia potentia est” - knowledge is power

Future of Public Transport

1. If travel is a utility, then mobility must be a service
   - Seamless travel with collective transportation as the backbone
     - Best of high capacity public transportation for the bulk of travel distances
       - Travel collectively = system efficiency
     - Localized services for short trips and first-mile, last-mile connectivity
       - Individual needs for origin to destination
   - Mobility must be transformed to be seen more like a high quality utility
     - Connection from one service to another must be efficient and pleasant
     - Good information and minimal delay

Future of Public Transport

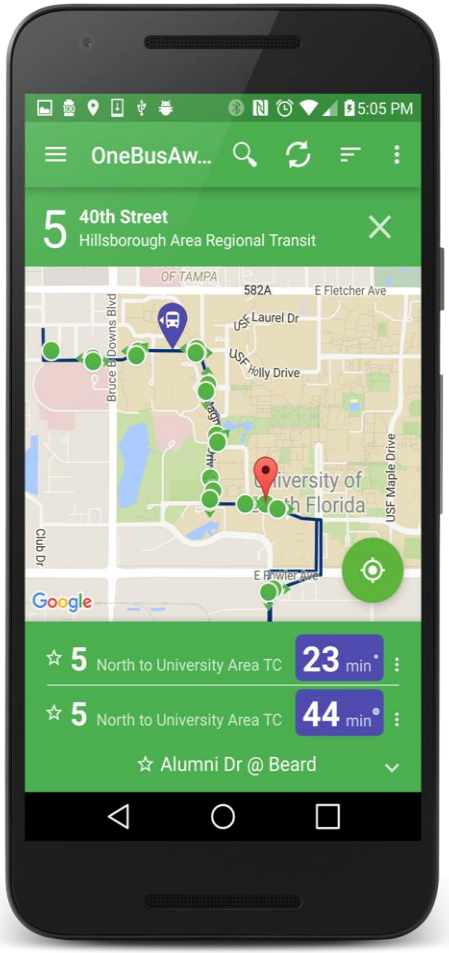
2. Spatial priority must be given to collective transportation modes
   - Transit + carpooling mixed with general traffic = no incentive to share
   - Exclusive right-of-way to collective transportation modes
     - HOV lanes, transit lanes, BRT must become the norm
     - Heavy rail versus bus has never been about steel vs rubber wheels
   - Spatial allocation for collective modes much more important with driverless vehicles

Future of Public Transport

3. Focus first on service, then on technology
   - Streetcar? Gondola? Hyperloop? Don't chase technology
   - First create a connected, accessible transit network
   - Link major nodes with frequent service
   - Minimize number of modal transfers

Future of Public Transport

4. “Scientia potentia est” - knowledge is power
   - Use of technology and data to improve transit services has been far too slow for transit to compete
   - Information intense society
     - Inform customers in real-time
     - Open data kept updated
     - Service disruption alerts
     - Customer feedback mechanisms



Takeaways

- Many in industry are assuming driverless vehicles will automatically be shared
  - Little evidence to show this is true

- Individuals who are using space efficiently must receive priority over those who congest the network
  - Design for preferential right-of-way for transit
  - Price the travel of vehicles

Thank You!

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Civil & Environmental Engineering

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@transitmom

Shared Autonomous Shuttle Project

CITY OF CHAMBLEE Georgia

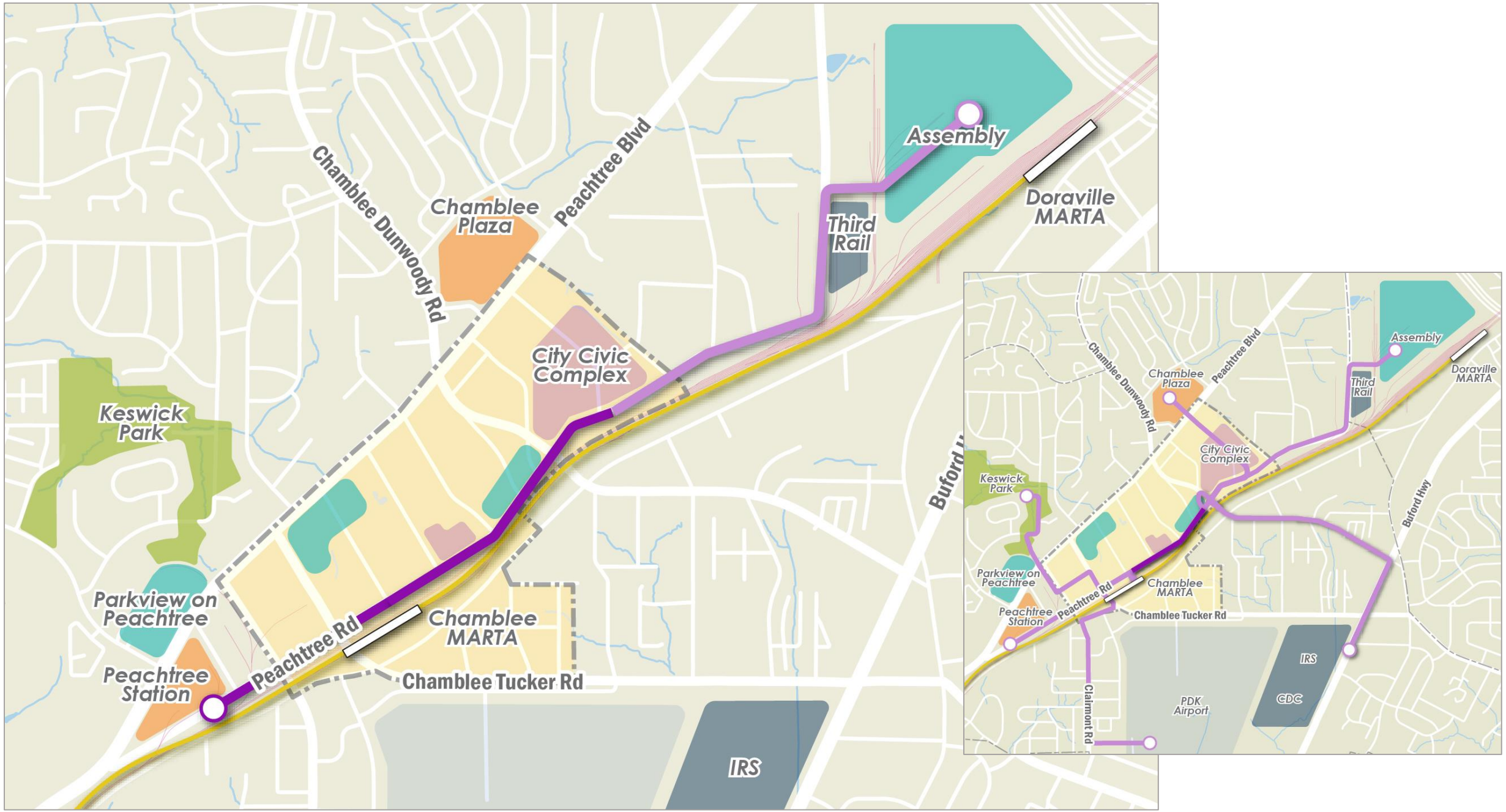
Feasibility Study and Capital Improvements

1. Phase I

Phase I

Feasibility Study:

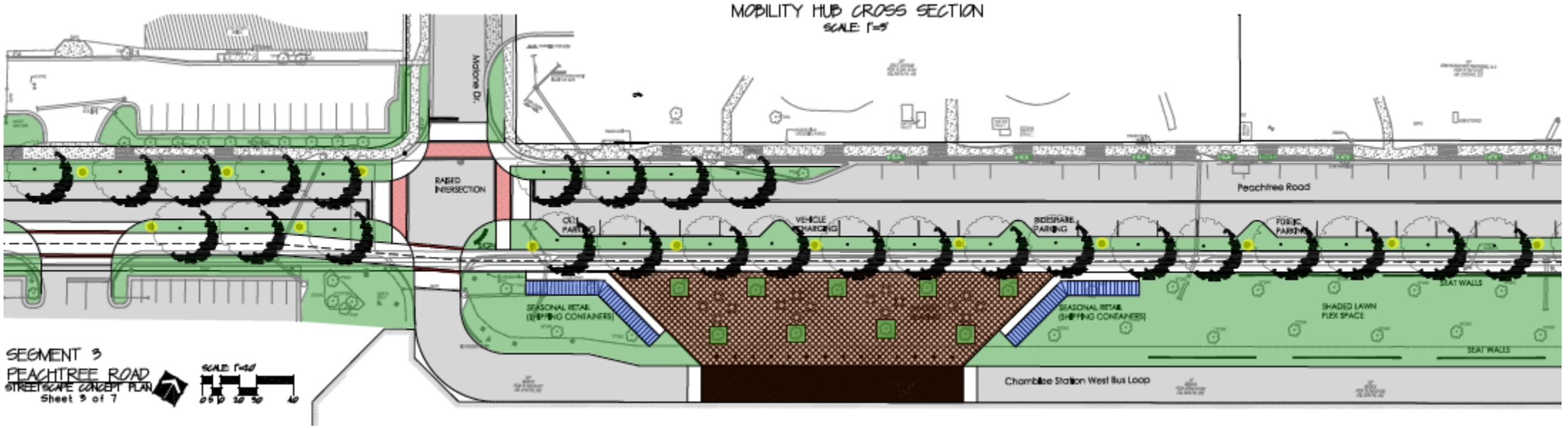
- Description of technology
- Chamblee analysis
- Cost estimates
- Route alternatives
- Recommendations
- Next steps


Assembly
Chamblee Dunwoody Rd
Peachtree Blvd
Chamblee Plaza
Third Rail
Doraville MARTA
City Civic Complex
Keswick Park
Parkview on Peachtree
Peachtree Station
Peachtree Rd
Chamblee MARTA
Chamblee Tucker Rd
IRS
Buford Hwy
Clairmont Rd
PDK Airport
CDC

Phase I

Peachtree Road Streetscape:

- Road diet
- Safety and operational improvements
- Future project – MARTA Mobility Hub



Smart Communities Challenge

2. Phase II

GEORGIA **SMART**

COMMUNITIES CHALLENGE

Georgia Tech

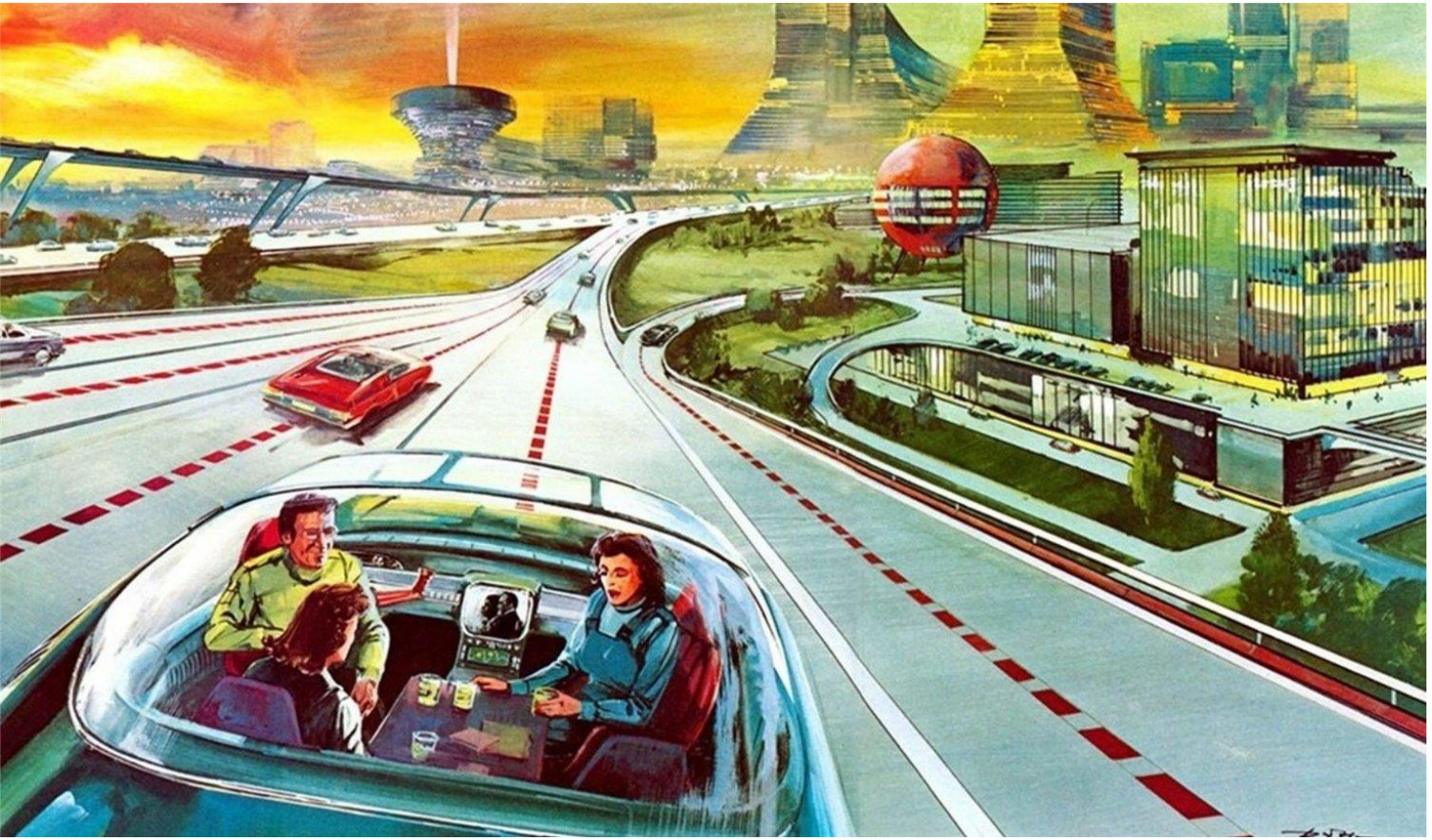
Challenge Scope

Research:

- Ellen Dunham-Jones + Zach Lancaster – Best Practices Manual

Implementation:

- Stantec – Operations Plan

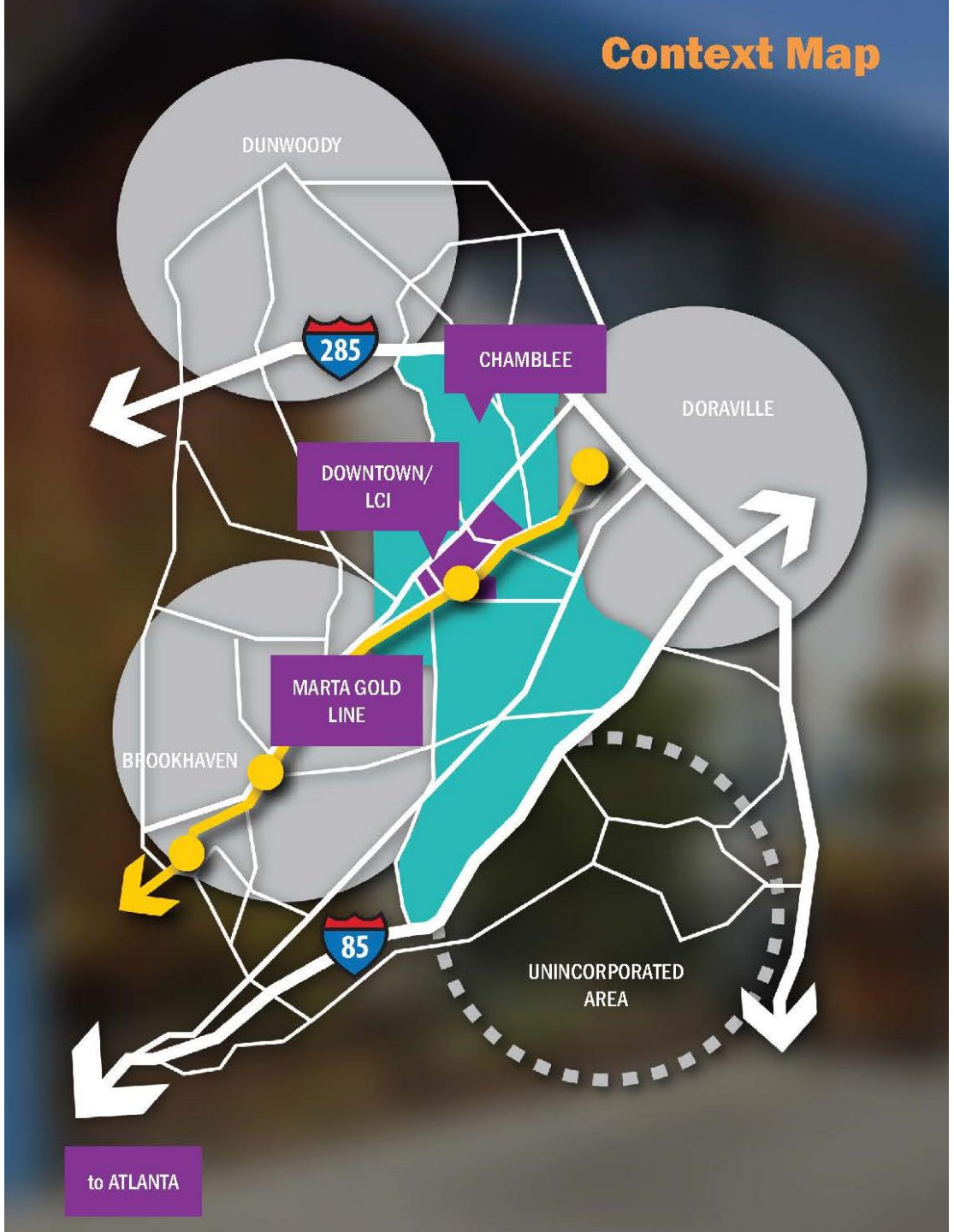


www.analyticsindiamag.com

Research

Best Practices Manual:

- Study of how the prevalence of autonomous vehicles will alter user preferences (mode choice, commute distance, parking ratios) that will eventually impact land use patterns.
- Research into the user experience at existing and proposed SAV installations.
- Design of the mobility hub adjacent to the MARTA station.
- Proposals for retrofitting existing parking lots and garages to park fully autonomous fleets or for more intense redevelopment.



Implementation

Operations Plan:

- 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 (if applicable) and procurement of system/services
- Risk assessment and mitigation strategies
- Emergency response plan
- Licensing requirements
- Cost estimates

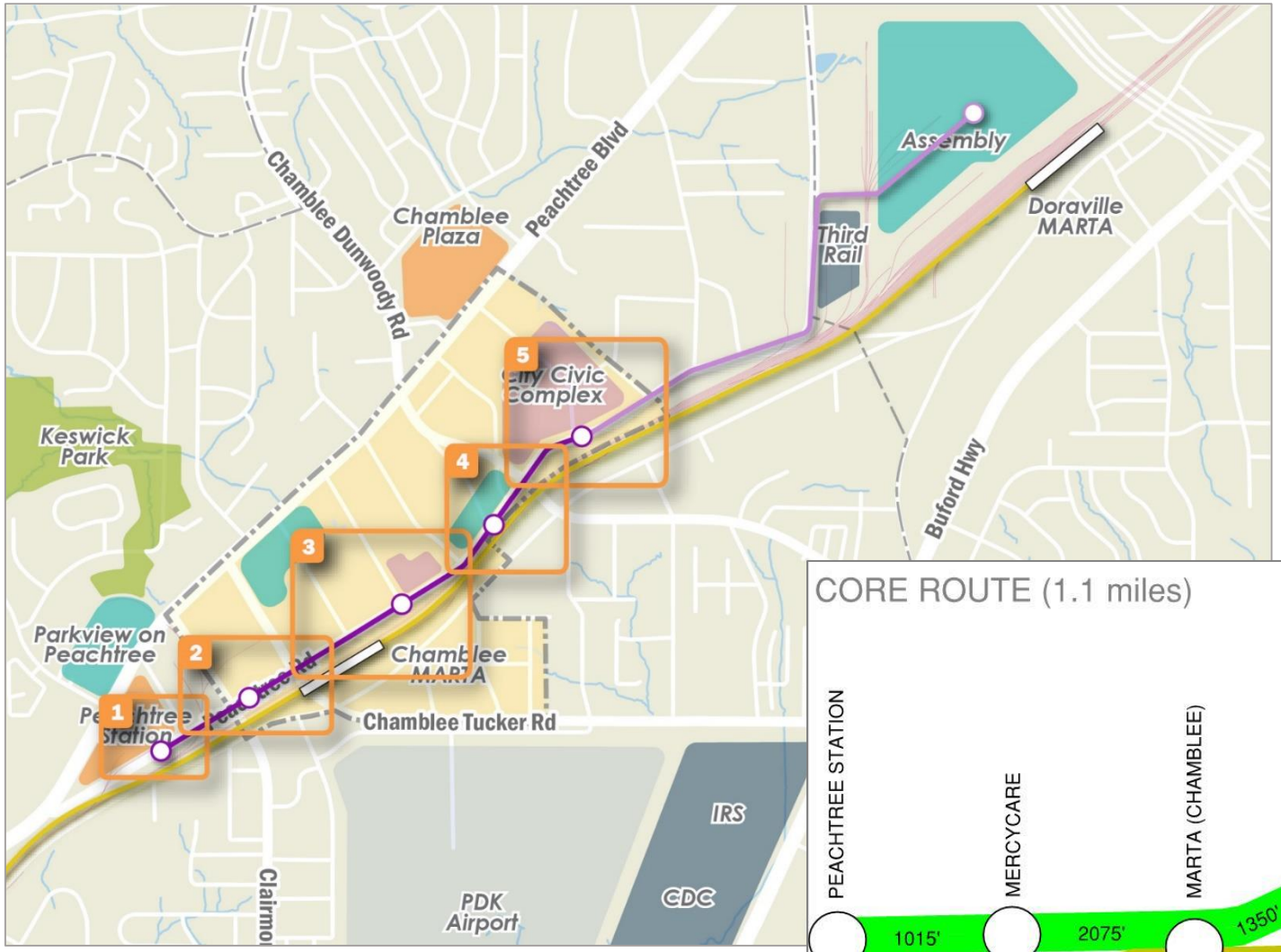
Route Analysis

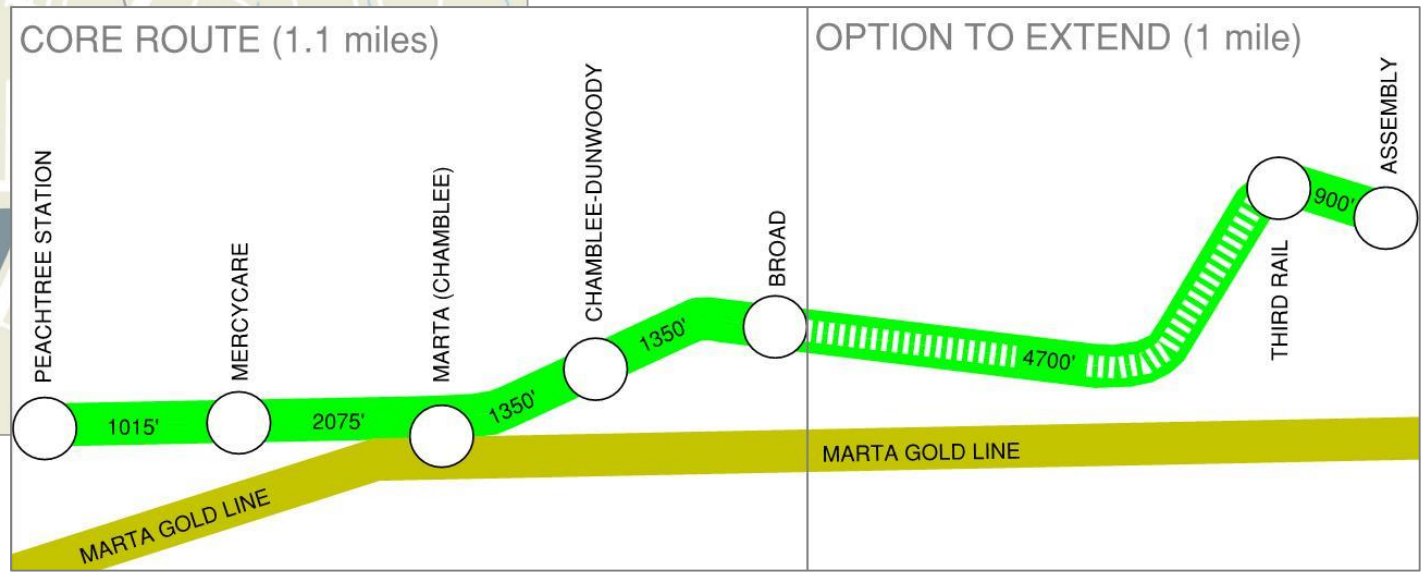
Core Route:

- Peachtree Station to Broad Street

Extended Route:

- Broad Street to Assembly Yards

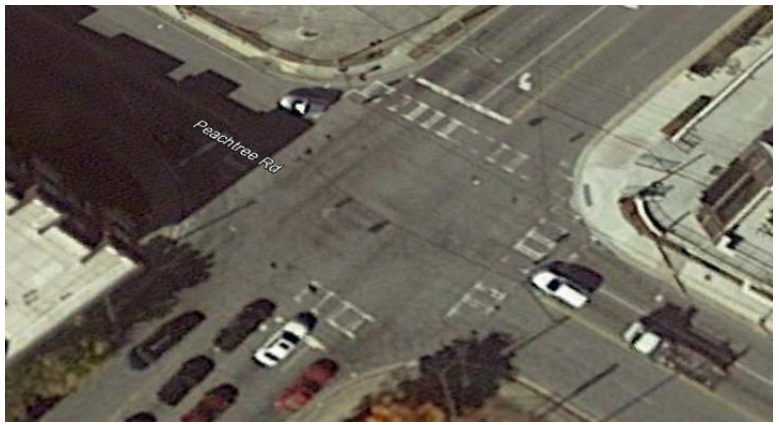




Chamblee Tucker Intersection

Required Improvements:

- Connected intersection



SAV Stops

Required Improvements:

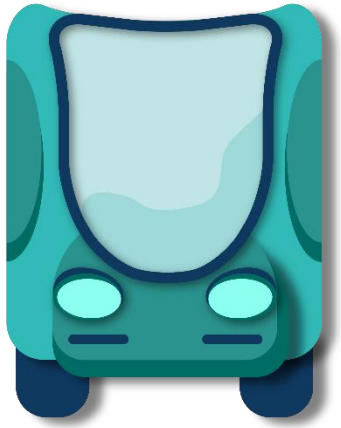
- ADA concrete landing pad
- Sidewalk connectivity
- Signage

Operations

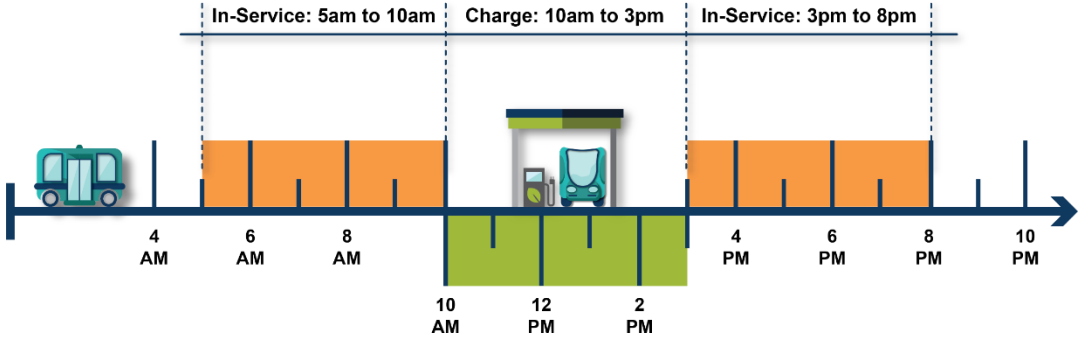
Peachtree Station - Assembly

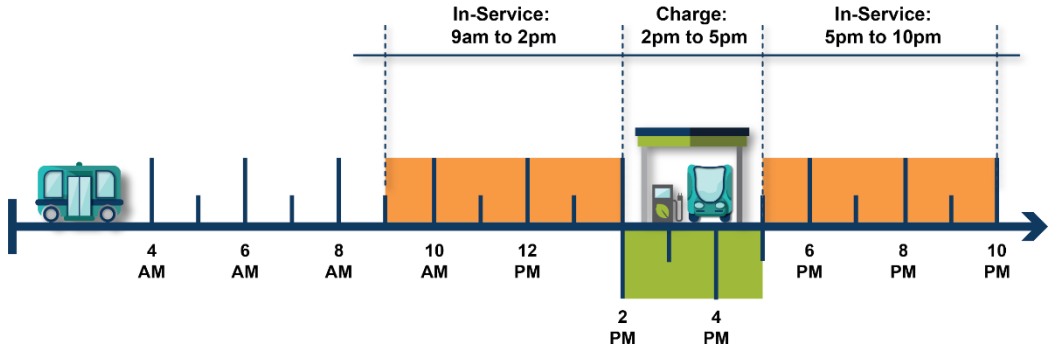
Length = 2.1 miles

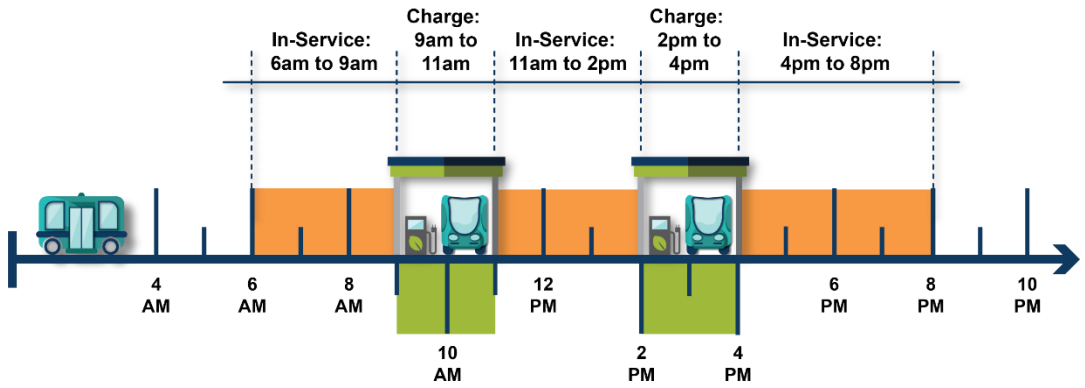
10 hour service day /
7 days / week



Single SAV (no spare)
= 15-minute headway







Service Profile

- Commuter / Last Mile Service
- Leisure/Entertainment
- Hybrid

Estimated Cost to Implement

Infrastructure Improvements
$75,000 - $100,000

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

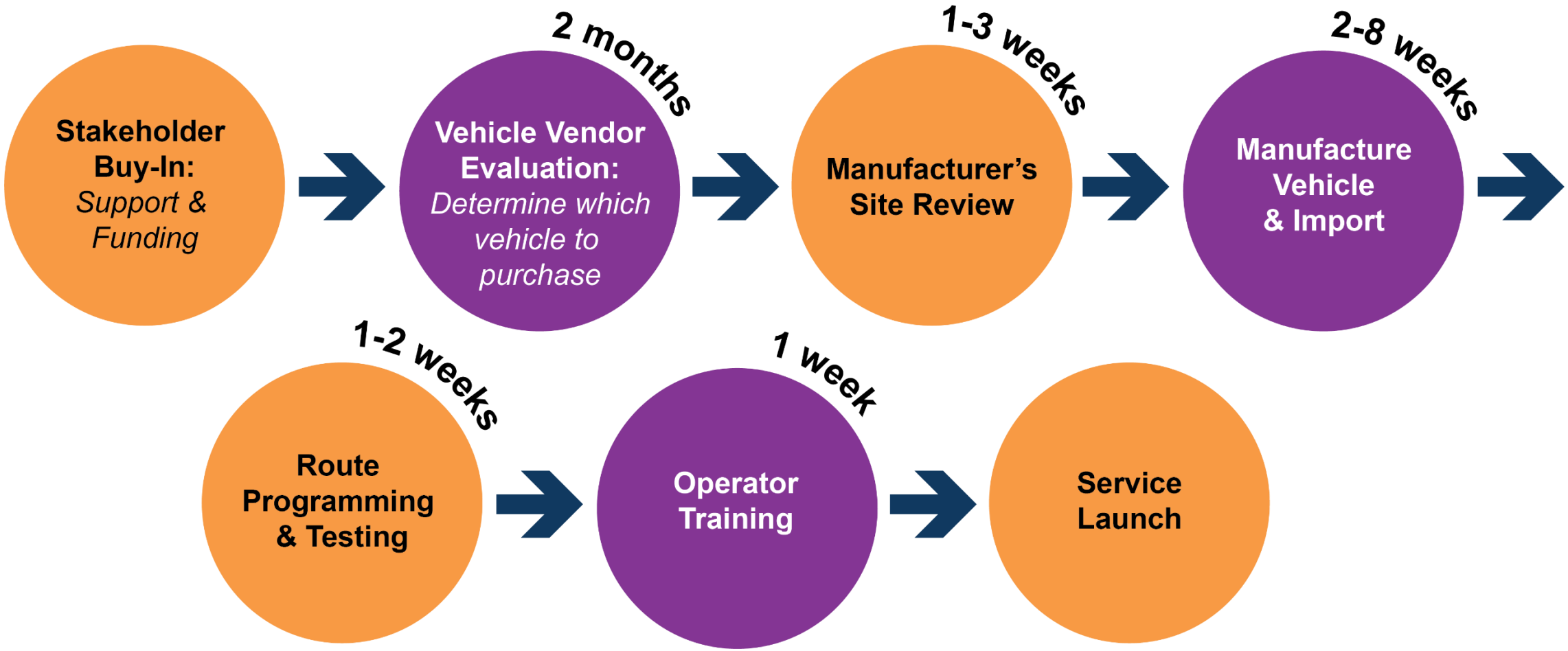
Capital Expenditures
$10,000 - $35,000 (monthly lease)
$250,000 - $425,000 (own)

- Vehicle
- Start up training & programming

Annual Operating Costs
$250,000 - $350,000

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

Next Steps


Stakeholder Buy-In: Support & Funding
2 months
Vehicle Vendor Evaluation: Determine which vehicle to purchase
1-3 weeks
Manufacturer's Site Review
2-8 weeks
Manufacture Vehicle & Import
1-2 weeks
Route Programming & Testing
1 week
Operator Training
Service Launch

Deployment

3. Phase III

USDOT Grant

- Significant Public Benefits
- Economic Vitality
- Complexity of Technology
- Diversity of Projects
- Transportation-challenged Populations
  - Last mile connectivity; rate of car ownership; vehicle and stop accessibility
- Collaboration
- Data
- Scalable

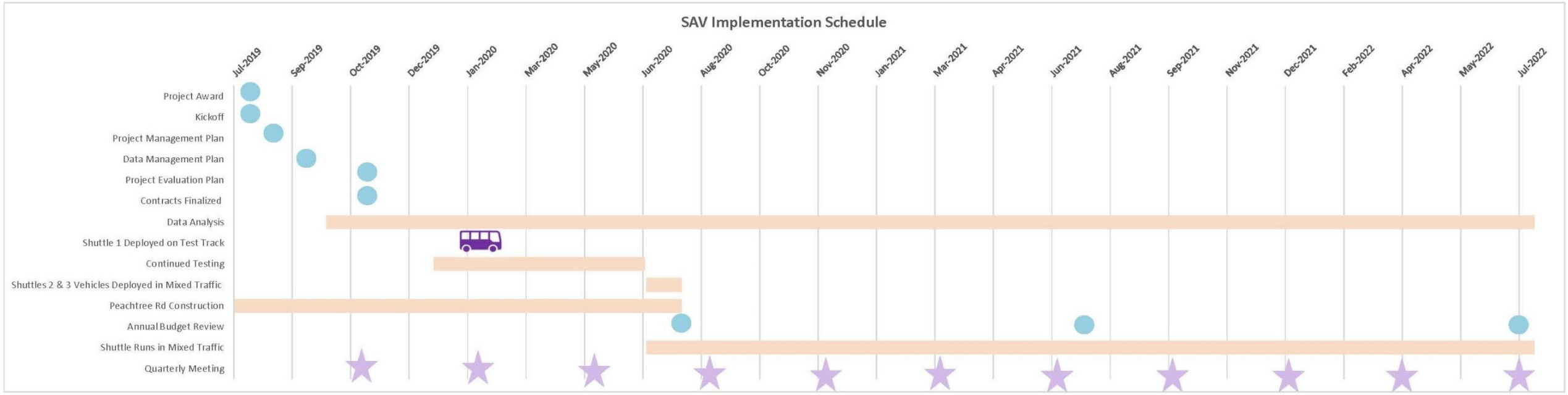
Partners + Supporters

- ATL
- GDOT
- ARC
- GTRI
- EasyMile
- Stantec
- CPL
- DeKalb County
- Senator Isakson
- Representative McBath

Data Collection

- Vehicle-level data for an AV shuttle operating at L4 in mixed traffic for safety analysis and rulemaking
- Test cases:
  - Weather conditions
  - Temporary construction zones
  - Vehicles or transit stopped in the travel lane
  - Vehicle collisions blocking the travel path
  - Pedestrians, cyclists, and other users
  - Other scenarios which will strain the current state of the art autonomous systems
- Understanding and recommending potential requirements for data and communications requirements to promote safer AV use on-road

Grant Schedule



Budget

General Budget – Cost Share Totals	
Total Federal Share	$9,708,000
Total Non-Federal Share	$4,000,000
Total	$13,708,000

Detailed Budget – Year 1	Costs
Vehicle and related equipment	$450,000
Monitoring API	$35,000
3G/4G Plan	$6,000
Data Management subcontract	$1,200,000
Hardware equipment	$500,000
Additional Data Storage	$500,000
Private Transport Operator	$0
System Signage/information kiosks/stop amenities/furniture	$0
Easements	$500,000
Vehicle Storage/charging	$20,000
First responder vehicle pre-emption units/DSRC technology	$0
Marketing	$0
Vehicle Insurance	$20,000
Roadway modifications	$3,000,000
a. Total Federal Share	$3,231,000
b. Total Non-Federal Share	$3,000,000
c. Total Project Cost (a + b)	$6,231,000

Detailed Budget – Years 2 + 3 (each year)	Costs
Vehicle and related equipment	$900,000
Monitoring API	$35,000
3G/4G Plan	$6,000
Data Management subcontract	$1,200,000
Hardware equipment	$0
Additional Data Storage	$300,000
Private Transport Operator	$500,000
System Signage/information kiosks/stop amenities/furniture	$200,000
Easements	$0
Vehicle Storage/charging	$500,000
First responder vehicle pre-emption units/DSRC technology	$200,000
Marketing	$20,000
Vehicle Insurance	$20,000
Roadway modifications	$1,000,000
a. Total Federal Share	$3,881,000
b. Total Non-Federal Share	$1,000,000
c. Total Project Cost (a + b)	$4,881,000

CITY OF
CHAMBLEE
Georgia

Stantec

USDOT Automated Driving Systems (ADS) Demonstration Grants – MARTA & Aerotropolis Atlanta

April 25, 2019

Atlanta

Jason Hanlin
Technology Director – CTE
Nathaniel Horadam
Managing Consultant – CTE
Kirsten Mote
Program Director – Aerotropolis Atlanta CIDs

CTE Overview

- The Center for Transportation and the Environment (CTE) is a national 501(c)(3) non-profit that specializes in the development and deployment of clean, efficient, and sustainable transportation technologies.
- Since its start in 1993, CTE has managed a portfolio of over $530 million in team research, development, and demonstration projects.

CTE…

- Educates federal and state policymakers
- Assembles top-notch teams
- Writes winning proposals
- Oversees grant contracting, cash flow, and reporting
- Provides technical assistance to early adopters
- Manages technology demonstrations and deployments

CTE Activity Map

ADS Demonstration Grant Opportunity

- USDOT issued a Notice of Funding Opportunity (NOFO) on December 21, 2018 for up to $60M worth of grants for automated vehicle (AV) demonstration projects
- “must be used for demonstration grants that test the safe integration of ADS (automated driving systems) into our Nation’s on-road transportation system”
- MARTA is the project’s lead applicant and prime recipient
- 73 total applications representing diverse communities and public entities across the United States
- Award announcements expected by June 21 (“Spring 2019”)

ADS Demonstration Grant Objectives

Goals

1. Safety
2. Data for Safety Analysis and Rulemaking
3. Collaboration

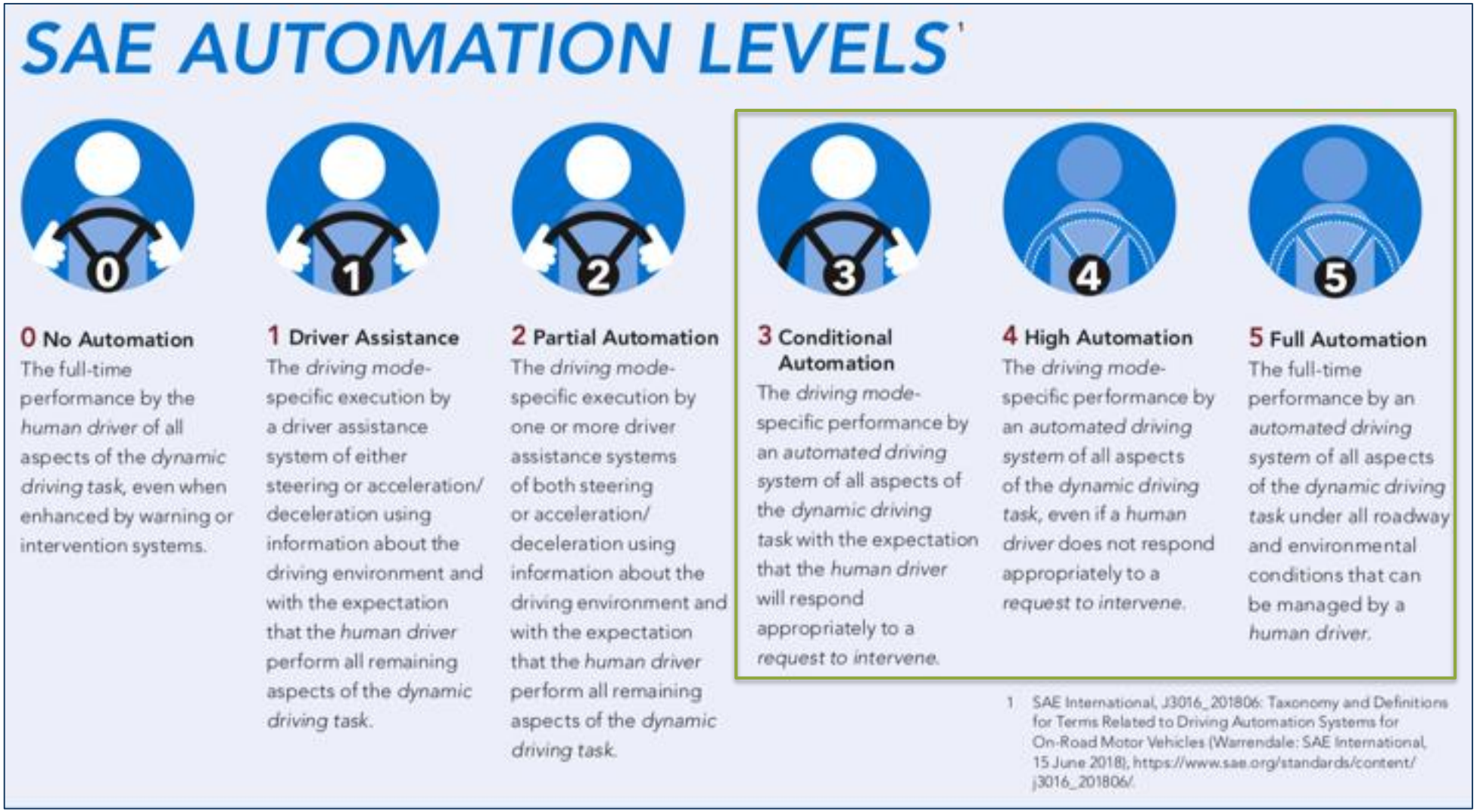
Focus Areas

1. Significant Public Benefit(s)
2. Addressing Market Failure and Other Compelling Public Needs
3. Economic Vitality
4. Complexity of Technology
5. Diversity of Projects
6. Transportation-challenged Populations
7. Prototypes

Project Summary

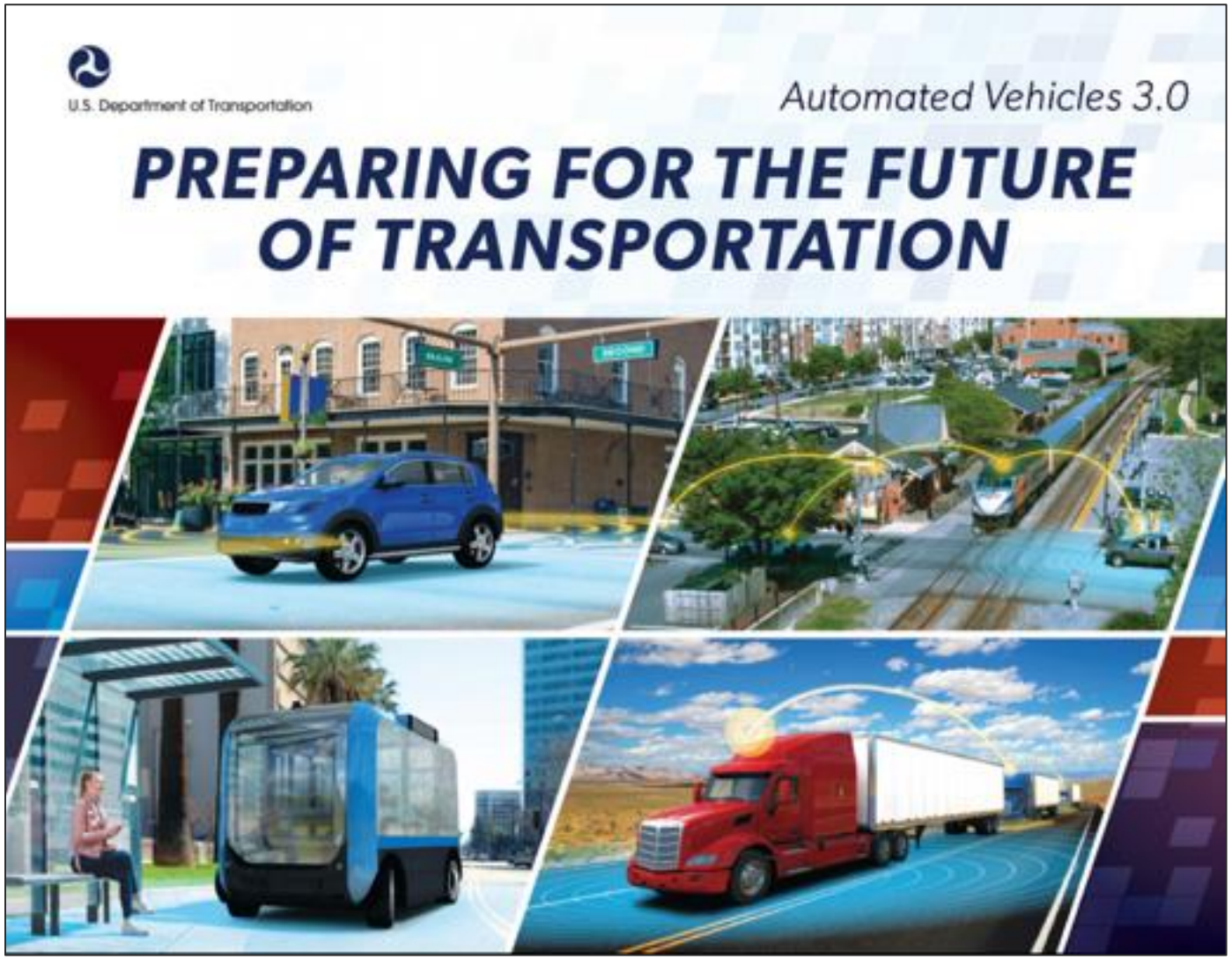
- The project would demonstrate two battery-electric buses outfitted with sensors, cameras, processing hardware, and software to support SAE Level 3+ automation
- They would operate on an alignment between the College Park MARTA Station and the International Terminal at Hartsfield-Jackson Atlanta International Airport. This would be the world's first airport AV demonstration on public roads
- The on-board technology would be collecting and processing performance data during service, which will be reported to USDOT to inform policymakers on the technology's safety applications
- There will be a driver on board at all times during the demonstration to ensure safe operation of the vehicle, and to gather data on driver interaction with the technology
- Depot charging infrastructure would be deployed to support electric bus operations

Levels of Automation



Credit: United States Department of Transportation

Federal AV Actions



Transit Automation

U.S. Department of Transportation

Notice of Funding Opportunity (NOFO) Number 693JJ319NF00001

"Automated Driving System Demonstration Grants"

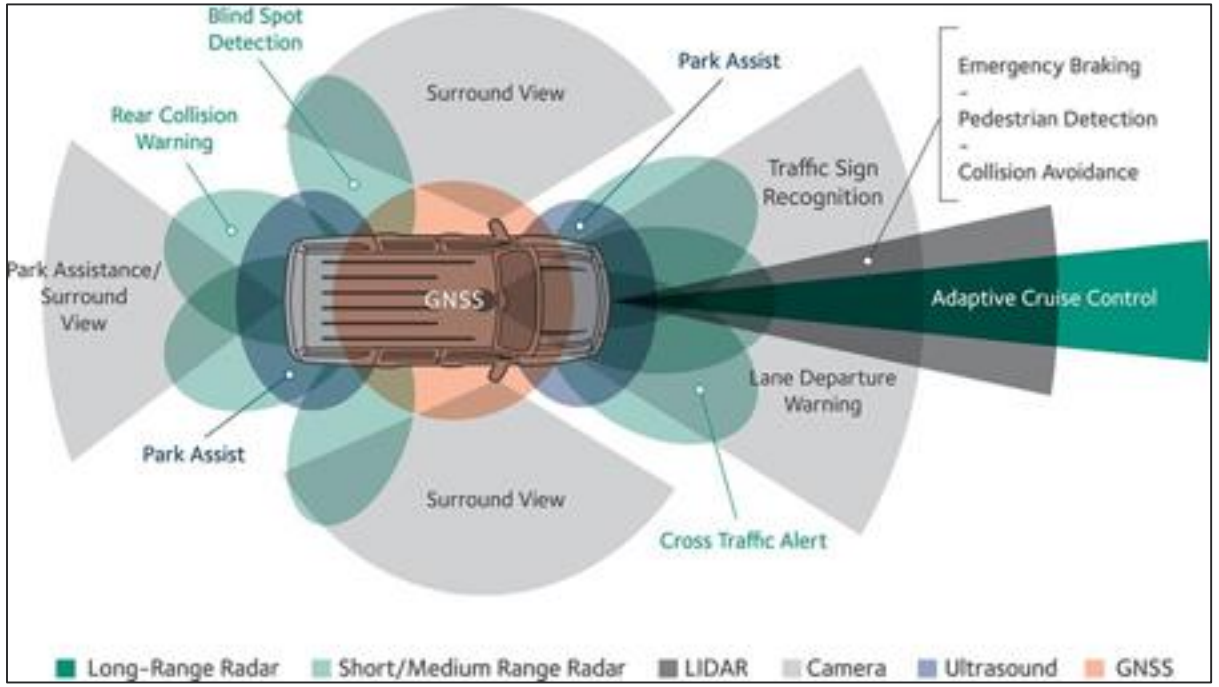
Issue Date: 12/21/2018

Application Due Date: 3/21/2019

ADS Technology Inputs

- Automation software
- Drive-by-wire capabilities
- Sensor architecture
  - Radar
  - Ultrasonic
  - LiDAR
- Cameras
- GPS/GNSS
- V2X communications (optional)
- 3-D mapping (optional)

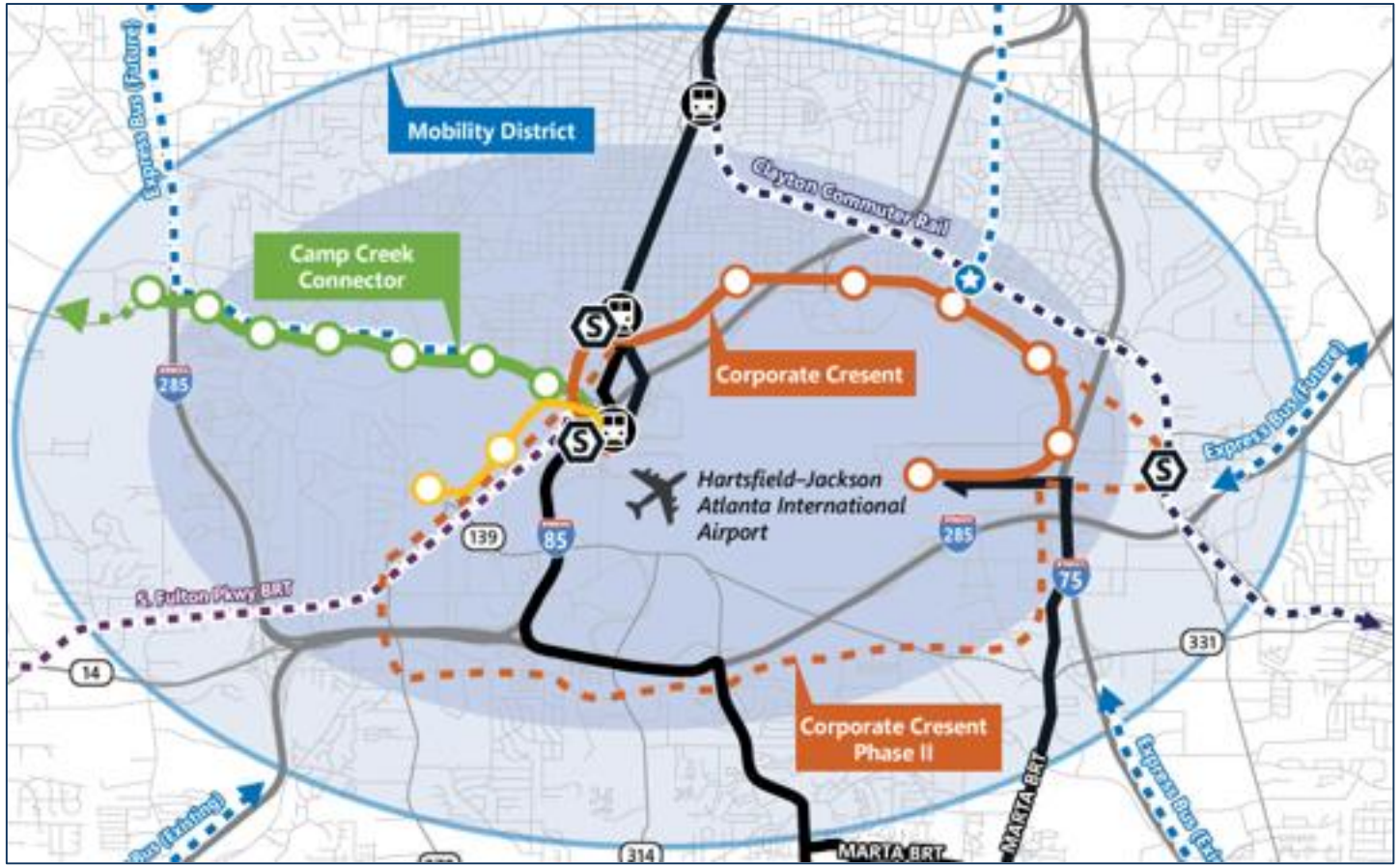
Sensor architecture



Credit: Novatel

Aerotropolis Transit Plan

- The Aerotropolis CIDs recently completed the first phase of their transit master plan
- The ”Corporate Crescent” circulator has been identified as a top service priority
- Aerotropolis is exploring multiple potential transit technologies for that route, including AVs



Credit: Aerotropolis CIDs

Aerotropolis Proposed Route(s)

*Redevelopment Zones identified in Aerotropolis Atlanta CIDs Master Plan (indicated in blue)

Project Team

Partners and Supporters

- Metro Atlanta Rapid Transit Authority (MARTA)
- Center for Transportation and the Environment (CTE)
- Aerotropolis Atlanta CIDs
- Hartsfield-Jackson Atlanta International Airport
- New Flyer
- *New Flyer ADS Technology Partner*
- Southern Company/Georgia Power
- ABM Industries
- The Atlanta-Region Transit Link Authority (The ATL)
- Georgia Department of Transportation (GDOT)
- Atlanta Regional Commission (ARC)
- Delta Air Lines
- City of Atlanta
- Cities of East Point, Hapeville, and College Park
- Fulton and Clayton Counties

Transit Bus Automation

Increase bus transit operational efficiency and safety

- Potential for highly or fully automated BRT operations
- Reduced liability and maintenance costs from fewer collisions
- Improved driver performance and reduced job stress from assistive features
- Increased efficiency of service from lane keeping features (shoulder driving), automated docking, and collision avoidance
- Reduced energy consumption from eco-drive features and faster travel speeds

Project Data

Data collected and reported to USDOT

- "Near misses" with pedestrians, other vulnerable road users, and other motorized vehicles, with object details
- Other failures to detect and appropriately respond to road users
- Failure to properly respond to road signage or signals, with object details
- Lane-keeping precision and deviations
- Docking precision for curbside pickup/alighting

Also:

- An inward-facing camera will capture the actions of safety drivers, and will be directed at their hands and feet to omit facial details. This will allow the team to assess safety driver responsiveness to ADS cues.
- Energy consumption metrics
- Rider and driver surveys

Contact Info

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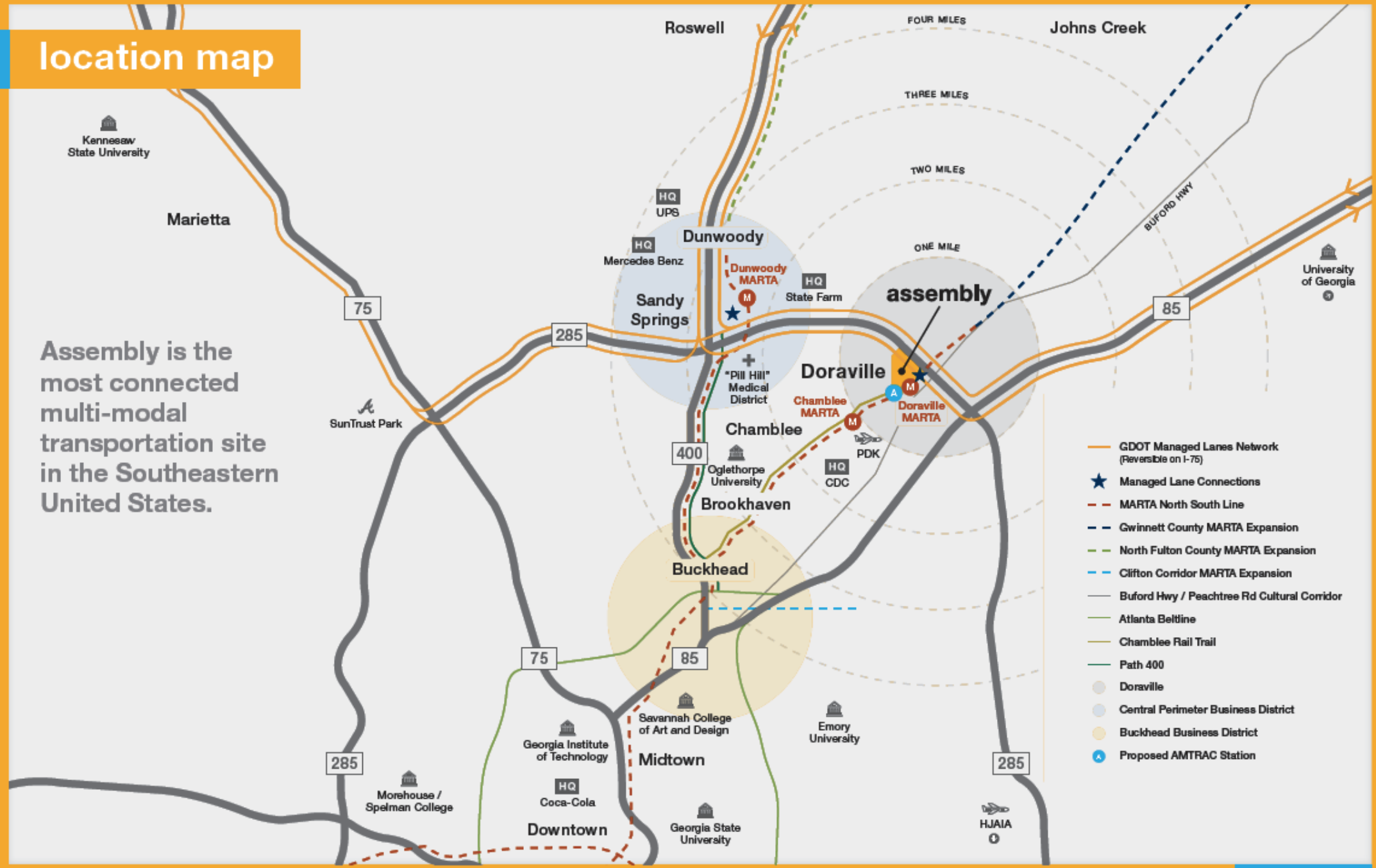
assembly


Integral
THE CITY OF
Doraville
Diversity, Vitality, Community
marta

location map



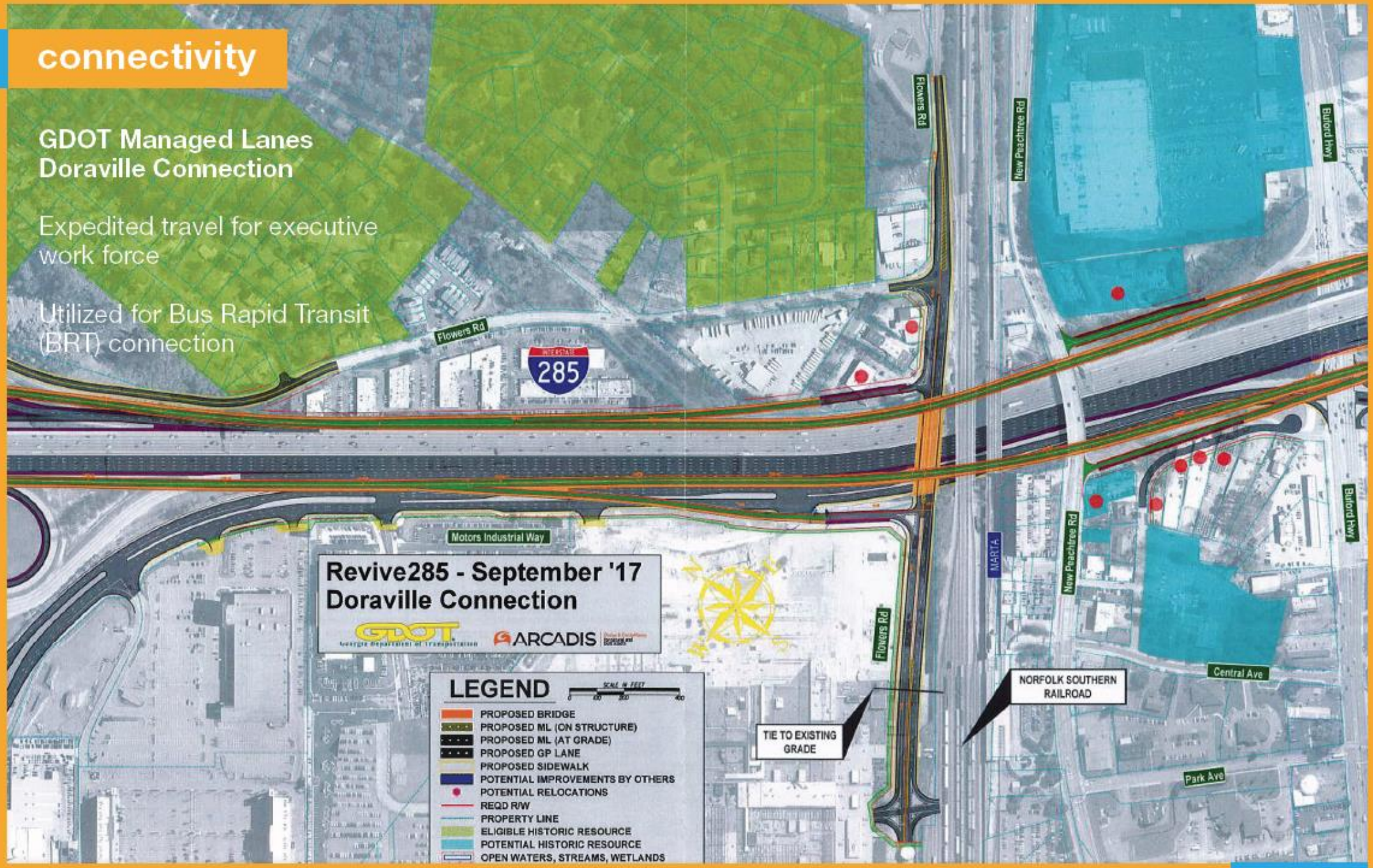
Assembly is the most connected multi-modal transportation site in the Southeastern United States.

connectivity

GDOT Managed Lanes
Doraville Connection

Expedited travel for executive work force

Utilized for Bus Rapid Transit (BRT) connection



assembly master plan

145 contiguous acres includes:

3+M SF Commercial Space

4,000 units multifamily

500,000 SF of retail

+/- 1M SF under way

Interior roadways

Greenspace

16 acre Central park

3 miles onsite rail, multi-use greenway loop

assembly master plan

145 contiguous acres includes:

3+M SF Commercial Space

4,000 units multifamily

500,000 SF of retail

+/- 1M SF under way

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assembly master plan

145 contiguous acres includes:

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+/- 1M SF under way

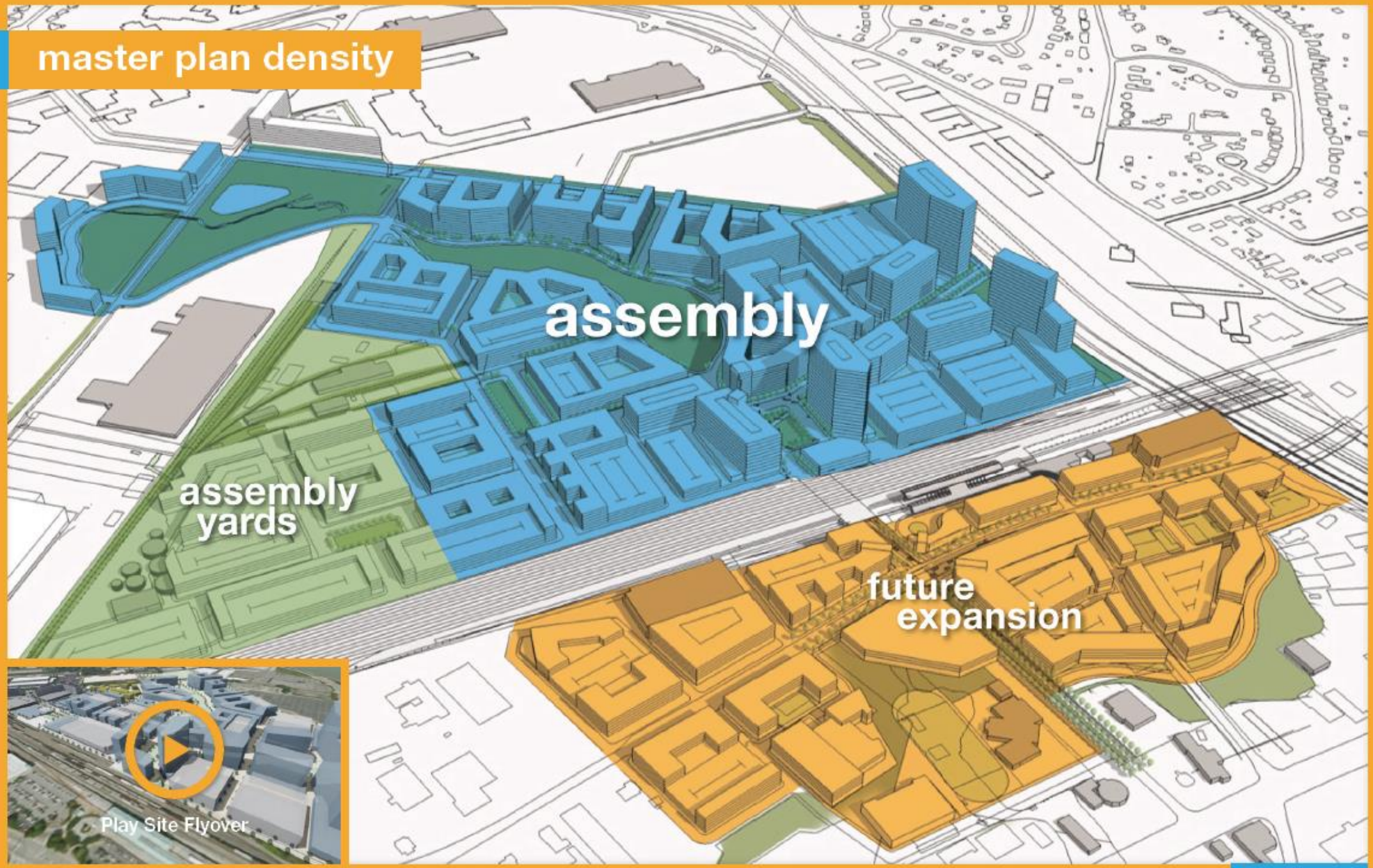
Interior roadways

Greenspace

16 acre Central park

3 miles onsite rail, multi-use greenway loop

master plan density



connectivity

Vehicular Travel

I-85 • 1 mile from Assembly

I-285 • adjacent to Assembly with 2 interchanges:
Peachtree Boulevard & Buford Highway

GA 400 • 4 miles from Assembly

I-75 • 10 miles from Assembly via I-285

Direct managed lane interchange onsite

sustainability

Largest adaptive reuse in the Southeastern United States

Planned District Utility

3/4 mile bioswale network on site

Central Chilled Water Plant

Powered with renewables and compressed natural gas

Water hub sanitary to Gray Water Recycling Plant

Solar farm capacity

Greenway infrastructure with 16 acre central park for: recreation, storm conveyance, storm detention

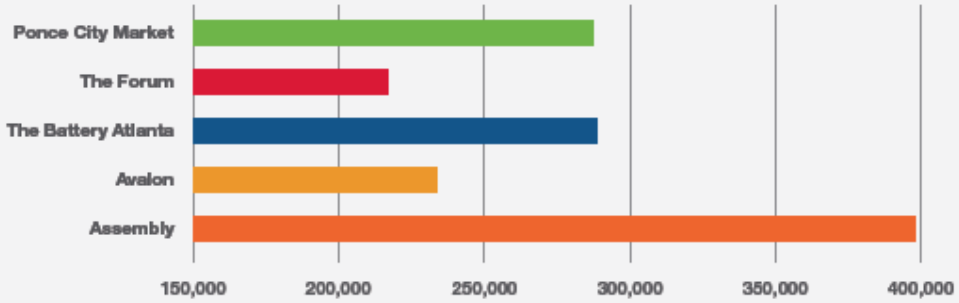
Planned autonomous shuttle

context imagery

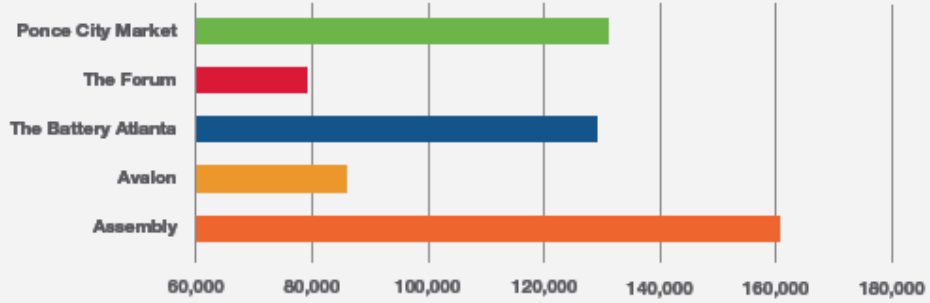
demographics

within a 15 minute drive radius

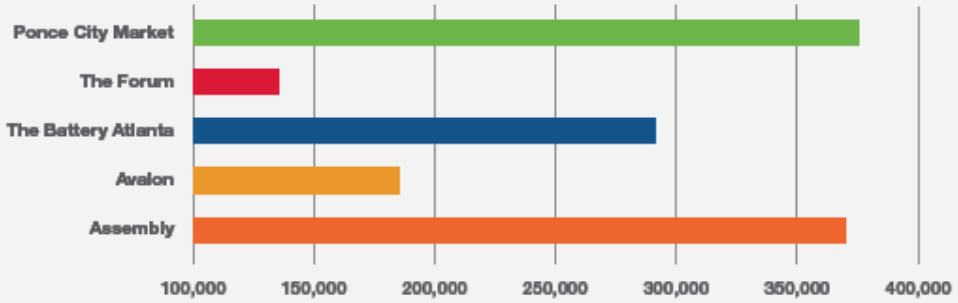
Population (2016)



Households (2016)



Employees (2016)



Average Household Income (2016)


THIRD
RAIL
STUDIOS
ASSEMBLY
YARDS

Committee Chair Remarks

- Marsha Anderson Bomar, Chair

ADJOURN