NATIONAL CENTER FOR APPLIED TRANSIT TECHNOLOGY

University-Transit Agency Partnerships to Explore Emerging Technology

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National Center for Applied Transit Technology

CITY OF GAINESVILLE
1869
STATE OF FLORIDA

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NATIONAL CENTER FOR APPLIED TRANSIT TECHNOLOGY

- Walking small agencies through the technology landscape
- Producing resources on adopting emerging technologies
  - Zero-emission vehicles, green infrastructure, data management, new software decisionmaking
  - Lessons learned, trends, strategies
- Providing in-depth technical assistance to adopting new technologies
  - Strike Teams and State Summits
  - Enabling technology transfer
- Developing hands-on workshops to understand how different technologies can be applied
  - Data Management, Digital Tools for Redesigns

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Find us at: n-catt.org

TACL: THE TRANSPORTATION TECHNICAL ASSISTANCE COORDINATION LIBRARY

http://transportation-tacl.org

The Transportation Technical Assistance Coordination Library (TACL) provides a sustainable methodology and platform for access and findability of coordination resources across a diverse range of transportation technical assistance centers and the Federal Transit Administration (FTA).

The FTA-funded technical assistance centers participating in this ongoing work with links to their coordination resources are:

- National Aging and Disability Transportation Center (NADTC)
- National Center for Applied Transit Technology (N-CATT)
- National Center for Mobility Management (NCMM)
- National Rural Transit Assistance Program (National RTAP)
- Shared-Use Mobility Center (SUMC)

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City of Gainesville Transit Autonomous Vehicle (AV) Pilot Project

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City of Gainesville

FDOT

university transit agency partnerships

TO EXPLORE EMERGING TECHNOLOGY

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City of Gainesville Transit Autonomous Vehicle (AV) Pilot Project

- Project Background
- Scope and Goals
- Phases 1 and 2
- Observations and Lessons Learned
- Future Phases

Project Background

- Project in Partnership with University of Florida (UF) and Florida Department of Transportation (FDOT).

- Vendor: Transdev Services, Inc.
- Vehicle Manufacturer: Easy Mile
- Start Date: August 2018

Scope and Goals

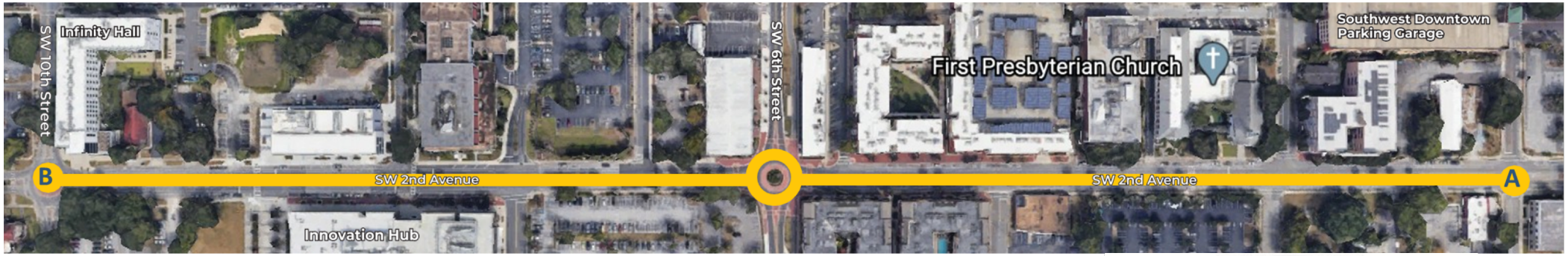
- To safely introduce Autonomous Vehicle (AV) service on public roads
- Shuttle between the University of Florida (UF) and Downtown
- UF research projects
- Phased approach
- 100% FDOT funding for Phases 1 and 2

Scope and Goals

- Test reliability and availability for a transit application
- Test Connected Vehicle Technology (V2I and V2X) Data sharing
- Workforce training
- Pedestrian/Bike detection
- Comparison with existing fixed-route services

Project Phase I – Initial Route

- City Parking Garage to Innovation Square



- 2 Vehicles
- 9 am to 3pm
- 10-minute frequency

Phase 2

- City Parking Garage to UF

- Vehicle to Infrastructure (V2I) Technology
- 2 Vehicles running every 15 minutes
- Service extended until July 2022

Observations and Lessons Learned

NHTSA (National Highway Transportation Safety Administration)

- Waiver granted for demonstrations and research, but not to transport passengers (March 2019 to January 2020)
- Suspension instituted for EasyMile vehicles (February 2020 – June 2020)
- Resume operations in August 2020 picking up passengers, under restricted conditions:
  - Operator on board
  - Do not operate in adverse weather conditions (heavy rain, fog or hail, winds greater than 31 mph and temperature below 0 degrees or above 95 degrees)
  - No more than 2 vehicles operate at any given time

Observations and Lessons Learned

NHTSA (National Highway Transportation Safety Administration)

- Resume operations in August 2020 picking up passengers, under restricted conditions:
  - Vehicles must be equipped with seatbelt at each position, audio alerts warning passengers
  - No passengers standing in vehicle
  - Video recordings
  - Training
  - Monthly reports

Observations and Lessons Learned

- Vehicle Speed:
  - Initially planned 20-25 mph, but currently operated at 9 mph. Number 1 complaint.
- Vehicle Size:
  - Vehicle could hold 12 passengers (6 seated, 6 standing) but vehicle operated with only seated capacity
  - Need bigger vehicle for Regular fixed route operations
- Vehicle Sensors:
  - Does not work well in heavy rain, near tree branches, reflective materials, and bicyclists
  - Does not detect anything under 18”

Observations and Lessons Learned

- ADA:
  - Vehicle ADA complaint in Europe but not in the USA
  - No wheelchair restraints
  - No ADA announcement devices on vehicle
- Operations:
  - Service interruptions: Debris, rain, wind, operator availability, software updates, etc.
  - Schedule was based on vehicle charging needs instead of operational needs
  - Vehicle manually navigates Roundabouts
  - Need to train IT technicians and AV operators

Observations and Lessons Learned

- Research:
  - Evaluation of the AV shuttle (before and after)
  - Changes after riding in the shuttle for:
    - PVA: 16 Individuals living with a spinal cord injury (18-64 years old)
    - STRIDE Phase I: 104 Older drivers (65+ years old) & STRIDE Phase II: 105 Younger and middle-aged drivers (18-64 years old)

Paralyzed Veterans of America

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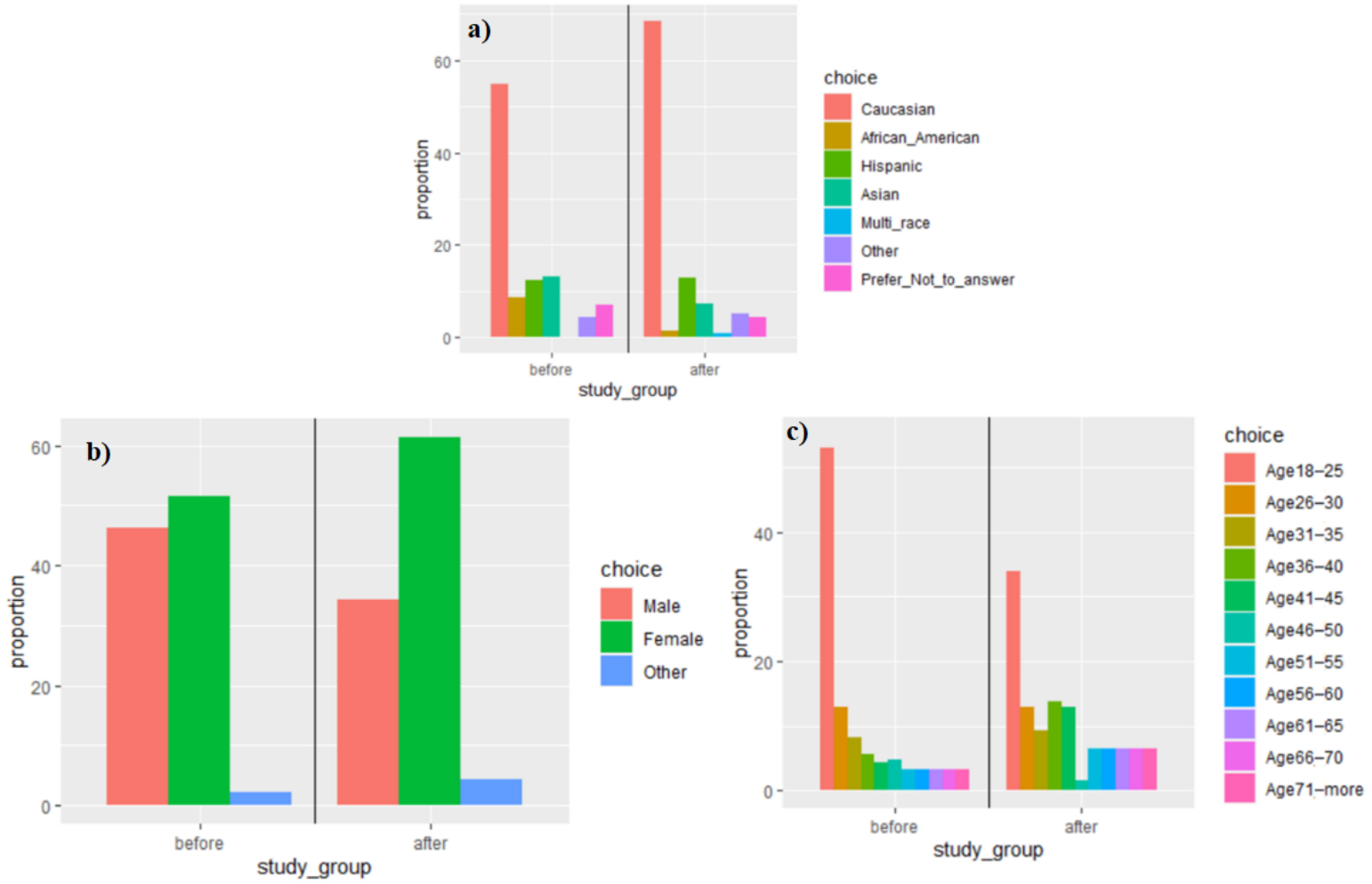
STRIDE | Southeastern Transportation Research, Innovation, Development and Education Center

RTS City of Gainesville TRANSPORTATION

Pre and Post Exposure Surveys

Travel Behavior and Technology Use	• Transportation Mode • Familiarity and usage of technology
Autonomous Shuttle Comfort and Safety	• Bus riders • Drivers • Pedestrians/Bicyclists
Demographics	• Age • Race • Income • Employment

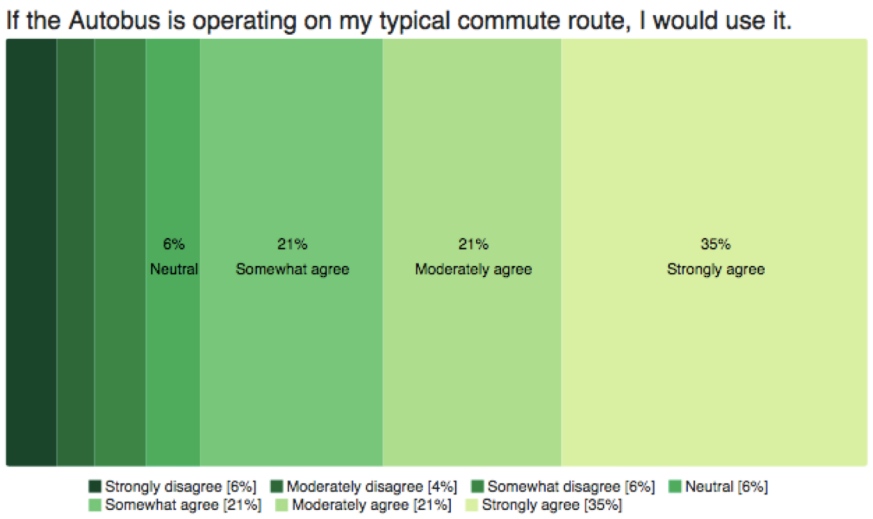
Survey Demographics

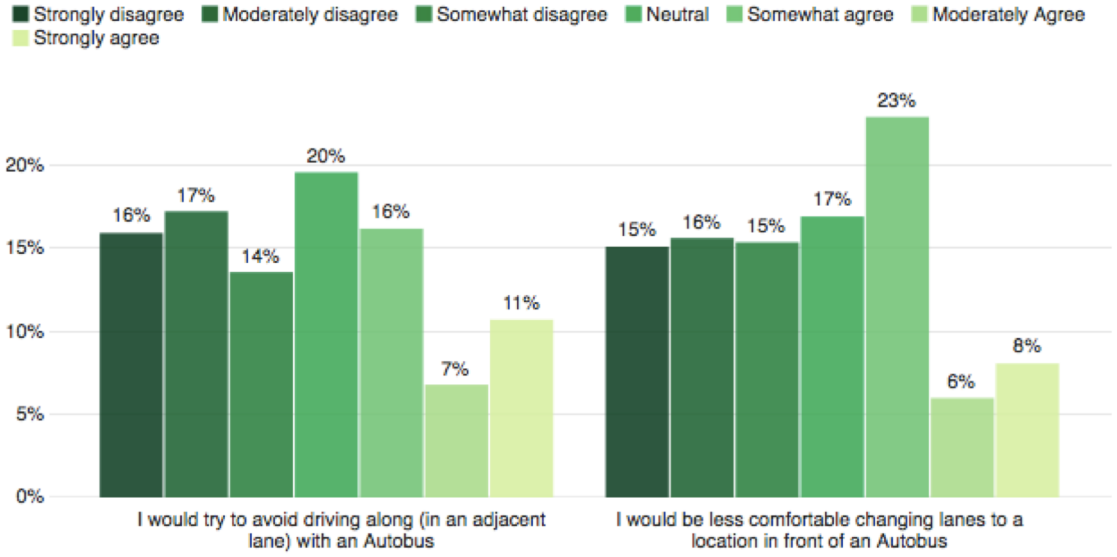


Gainesville AV Shuttle Evaluation – Before Study

- 550+ surveyed in 2018, only 1/3 of surveyed were aware of AV Shuttle

- **Riding the Autobus:** 77% agree that they would use the AV shuttle
- **Drivers are more confident**: Only 34% would avoid driving along and 37% would avoid driving in front
- **Cyclists/Pedestrians are less confident**: 43% of cyclists would avoid biking in an adjacent lane to an Autobus; 46% of pedestrians/cyclists would feel less comfortable crossing the road
- **Many Neutral/Somewhat responses**, Moderate confidence in the AV Shuttle, especially as a rider/driver

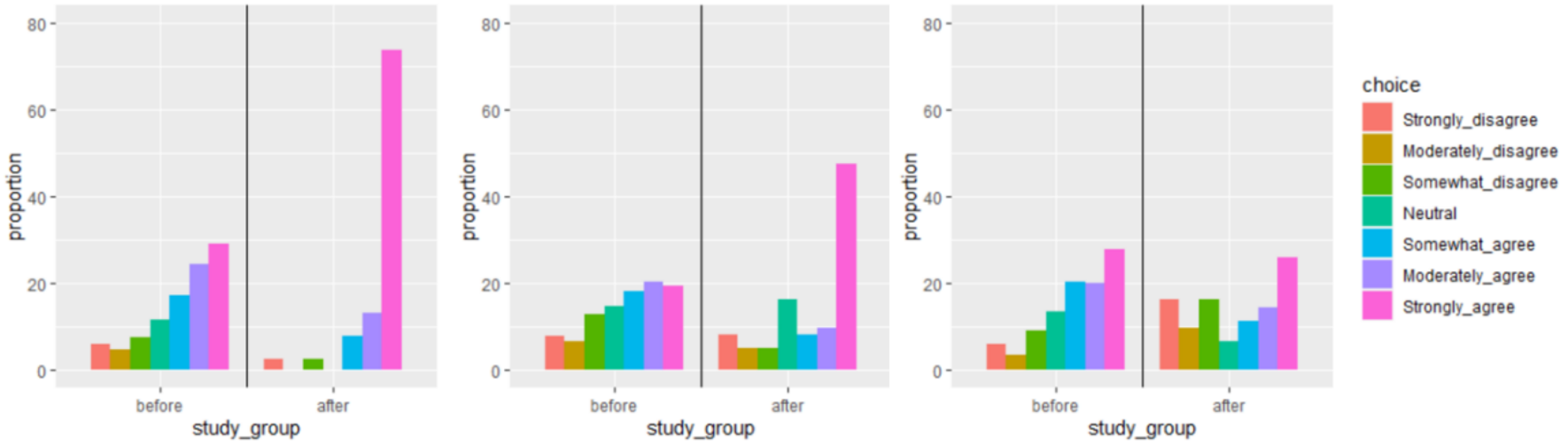




Gainesville AV Shuttle Evaluation – After Study

- 150+ surveyed in 2021, 7/10 (doubled) of surveyed were aware of AV Shuttle
- **Riding the Autobus:** 62% (- 15%) agree that they would use the AV shuttle, however of the people who have taken a ride in the shuttle, 100% of them agree that they felt “comfortable” and “satisfied” with the AV shuttle ride
- **Drivers are dissatisfied**: About 51% are dissatisfied with shuttle operations (slow speed mentioned as the main reason)
- **Cyclists/Pedestrians are satisfied**: 63% of cyclists are satisfied and 11% have neutral opinions on shuttle operations
- **Many divided opinions**: More “extremely satisfied” or “dissatisfied” answers than “somewhat” or “moderate” responses

"I am comfortable when I am _____" in/around Gainesville AS



Riding Walking/Biking Driving

Text Responses

- Speed
- Equity
- Availability of Information
- Social Distancing and Shuttle Size
- Route Location

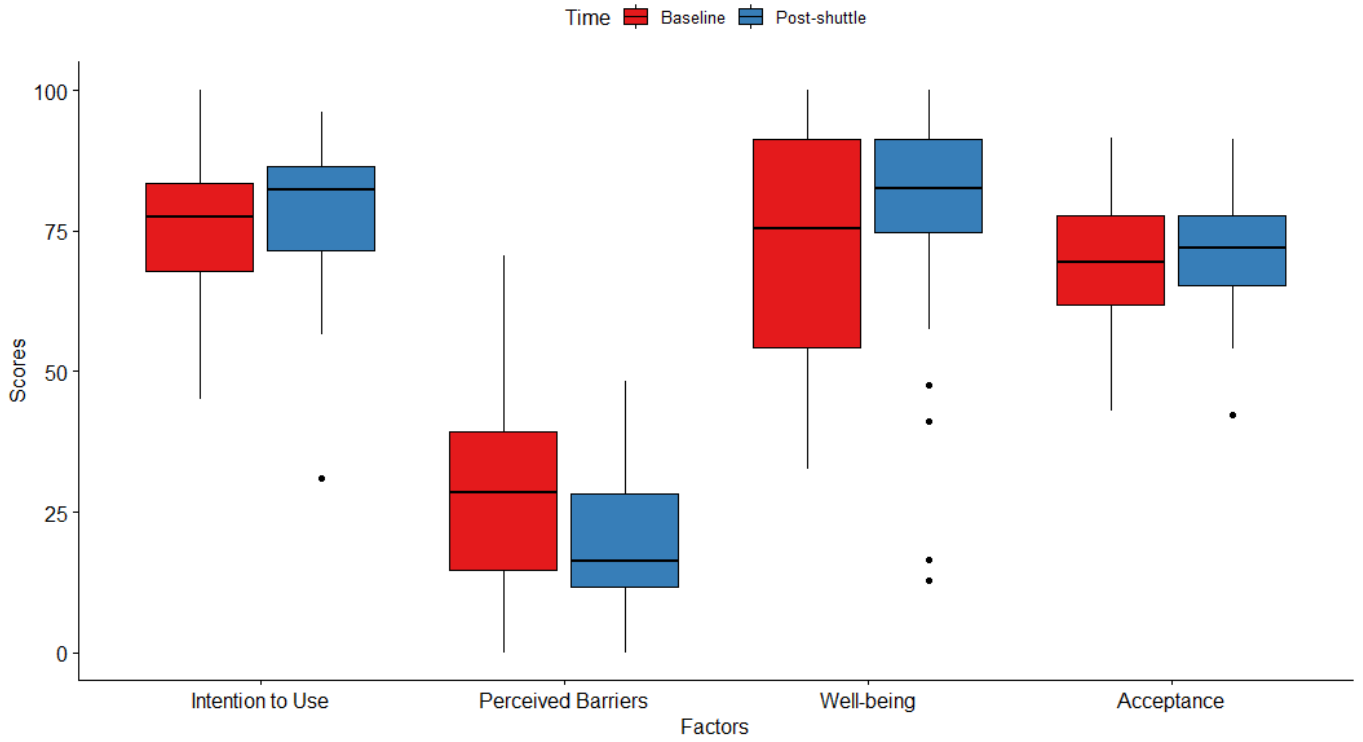
Study 2: Perceptions of individuals living with a SCI

- Eligibility of SCI participants
  - SCI must have occurred >6 months ago
  - ≥ 18 years of age
  - No signs of cognitive impairment (Montreal Cognitive Assessment)
- Sample size (N=32)
  - 16 SCI/D and 16 age- and gender-matched controls
- Pretest-posttest design
  - Automated vehicle user perception survey (AVUPS)
    - 28 items & 4 factors: Intention to use, Perceived Barriers, Well-being, & Total Acceptance Score
  - EZ10 shuttle in downtown Gainesville on public roads
  - AVUPS
- Analysis
  - Two-way mixed ANOVA (time, group, and group x time interaction) for the four AVUPS scores
  - Qualitative analysis is ongoing

Paralyzed Veterans of America

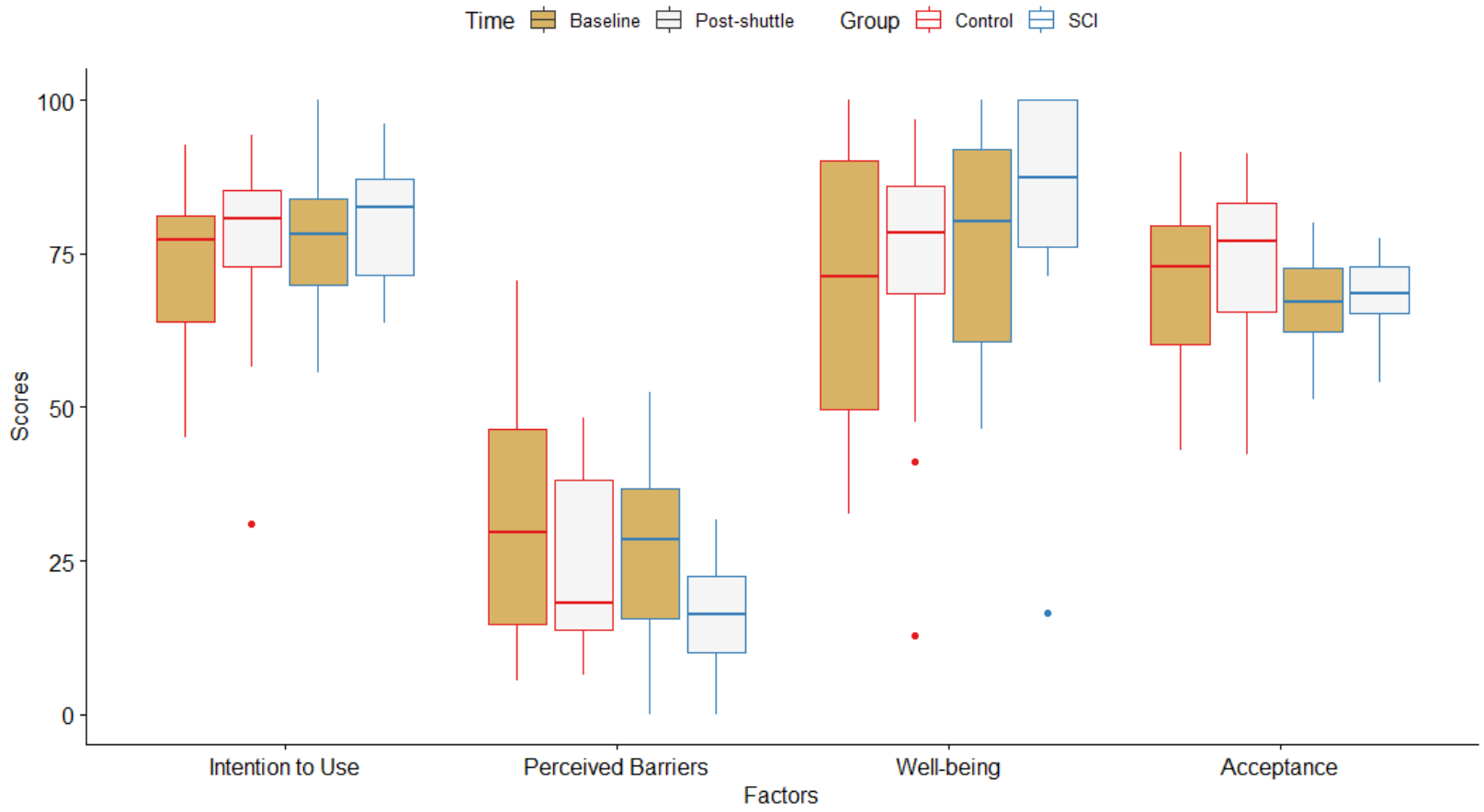
Study 2: AVUPS Results

- Time effect for Perceived Barriers, $F(1,60) = 3.26$, $p = .025$
  - Perceived barriers increased after riding in the shuttle ($M = 29.3$, $SD = 17.4$) compared to baseline ($M = 20.5$ $SD = 13.1$)



Study 1: AVUPS Results

- No group effect or group by time interactions were observed.



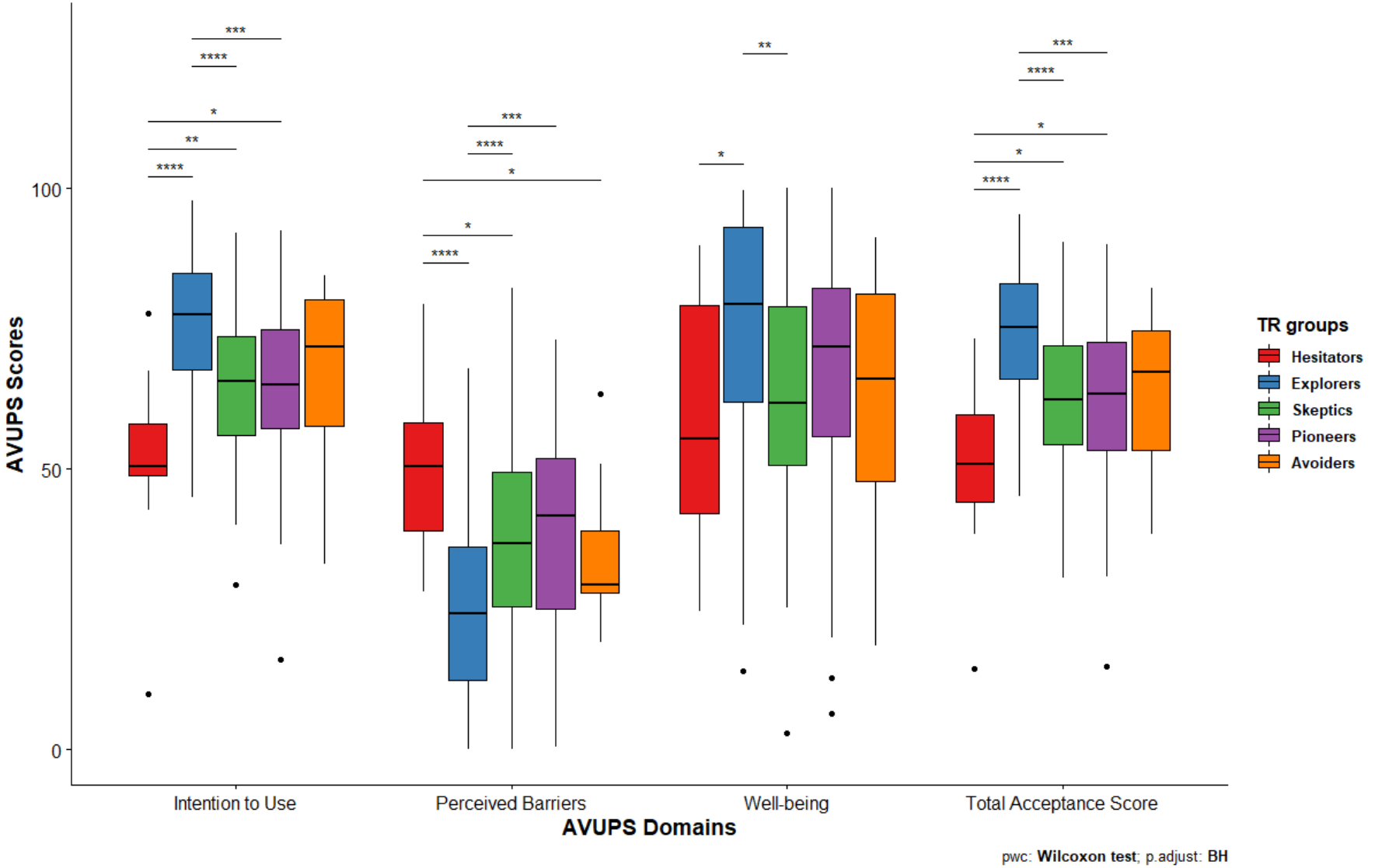
Study 2: Discussion

- Study was underpowered
  - Proposed sample was 53 per group
- Trends are similar between groups
  - Exposure to AVs positively influences users perceptions
- Modifications (i.e., ramp, securements, signs) were made to the EZ10 shuttle based on our weekly meetings between UF, City of Gainesville, EasyMile (vehicle manufacturer), and Transdev (vehicle operator)
  - Feedback from participants was shared in these meetings which facilitated discussion
- Design future study to include first-mile/last-mile dilemma.

Study 3: Adults across the lifespan

- Same research design (pretest-posttest), questionnaires, shuttle, route, and outcome measures (i.e., 4 factors of the AVUPS)
- Sample (N=210):104 older adults (65+) and 106 adults (18-64)
  - No differences/associations were found between their age and perceptions of AVs
- A latent class analysis utilized responses from the Technology Readiness Index (TRI) 2.0 (Parasuraman & Colby 2015)
  - The TRI 2.0 contains 16 items and 4 domains:
    - Optimism, Innovativeness, Discomfort, and Insecurity
- Participants were grouped as:
  - ***Hesitators*** - low Innovativeness
  - ***Avoiders*** - high Discomfort & Insecurity; low Optimism & Innovativeness
  - ***Explorers*** - high Optimism & Innovativeness; low Discomfort & Insecurity
  - ***Skeptics*** - detached view of technology w/ less extreme positive/negative beliefs
  - ***Pioneers*** - holding both strong positive & negative views about technology
- Age was not related to their TRI scores

Study 3: Results at Baseline

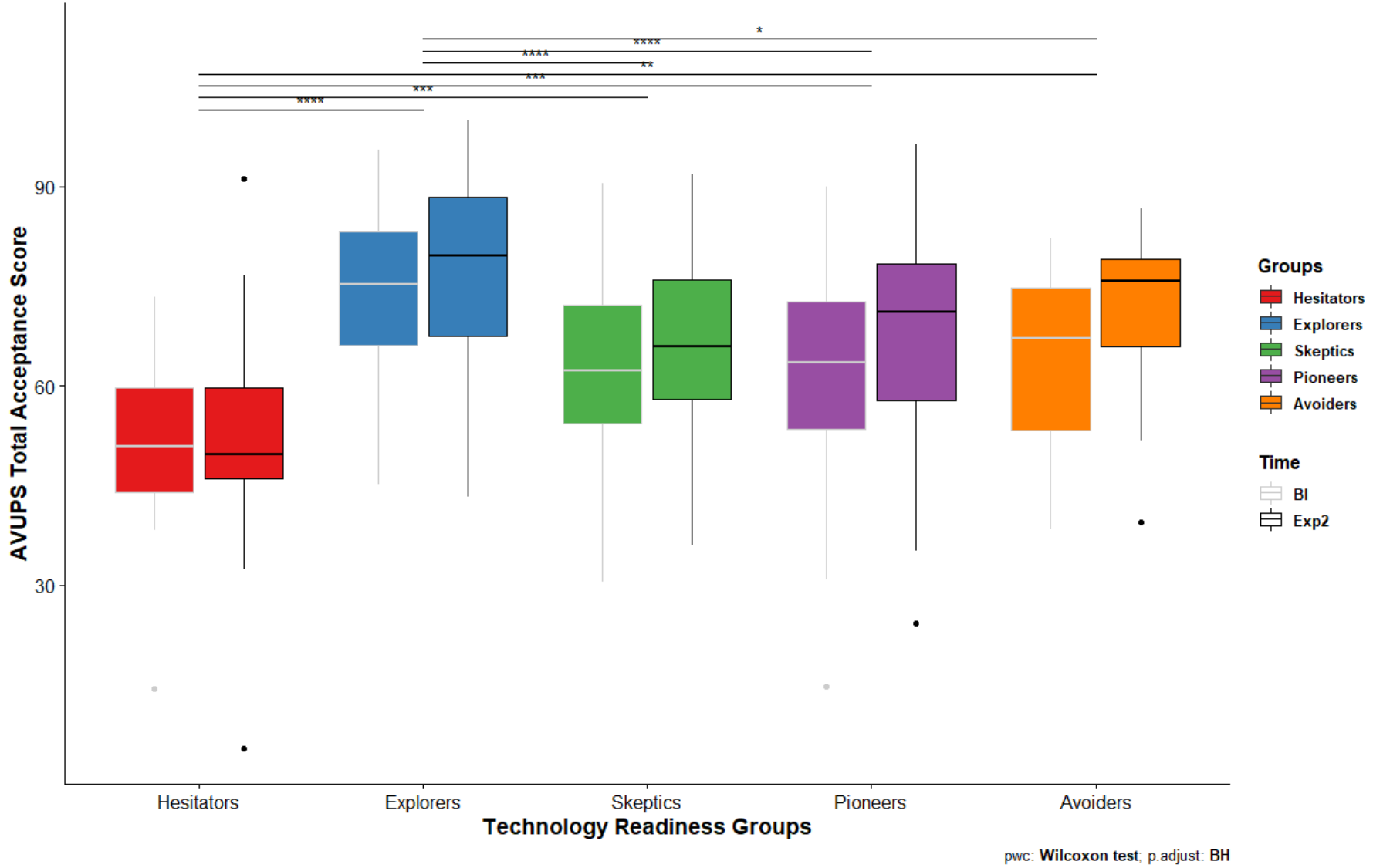


- Hesitators (low innovativeness):
  - Intention to Use ↓
  - Perceived Barriers ↑
  - Acceptance ↓

  compared to Explorers, Skeptics, Pioneers
- Explorers (optimistic):
  - Intention to Use ↑
  - Perceived Barriers ↓
  - Acceptance ↑

  compared to Skeptics & Pioneers
- *Skeptics* (neutral)
- *Pioneers* (strong +/-)
- *Avoiders* (opposite of Explorers)

Study 3: Results Pre- and Post- AS



- When grouping participants by their technology readiness, their perceptions of AVs remains relatively static.

Stakeholder Engagement

- NHTSA permit
- Interoperability and "Connected AS"
- ADA Compliance
- Ridership
- Technical Issues

What have we learned:

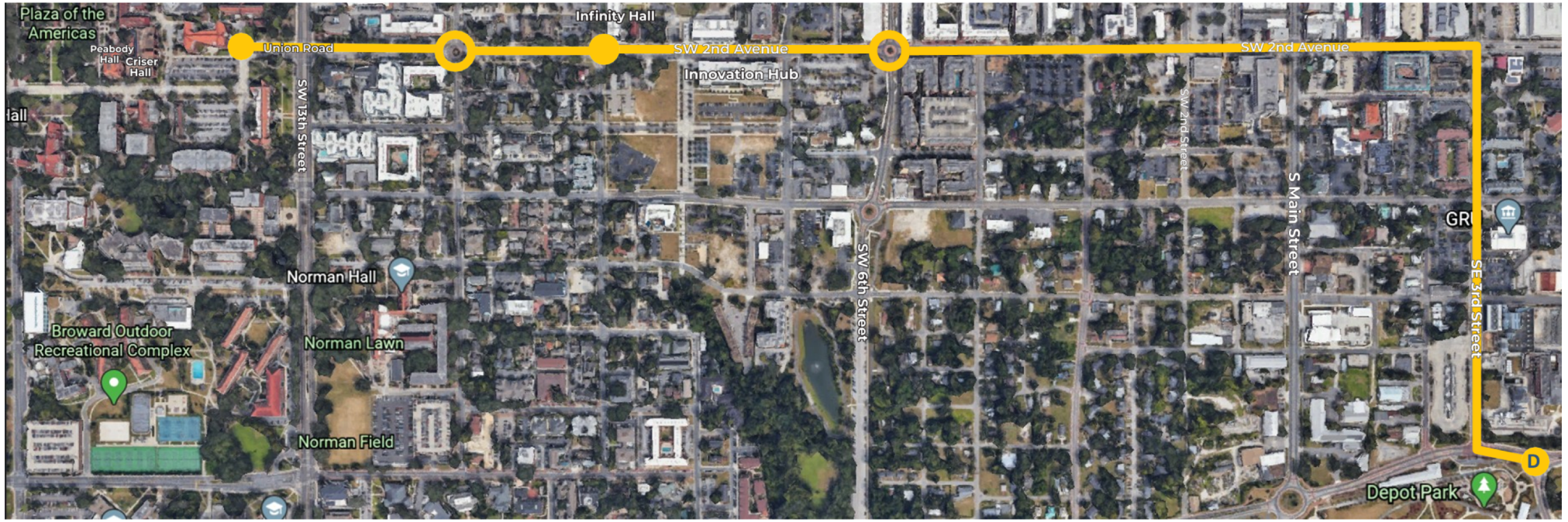
- Travelers become more comfortable once they experience this new technology
- The slow speeds of the AS may result in frustrated drivers, and affect future deployments of AS
- Partnerships are essential (research to implementation, automotive engineering to transportation systems engineering, to human factors)
- Community engagement is essential in acceptance of new technologies

Where do we go from here?

- Deployments should:
  - Provide passing opportunities
  - Ensure stakeholder collaboration
  - Engage communities
- As deployments increase, the general public will likely embrace the technology – exposure promotes acceptance
- Higher speeds will be essential for extensive deployments
- Acceptance will allow for elimination of staff on-board

Future Phases

- **Phase 3 and 4:** UF to Depot Park (requires additional funding to continue)



- Expansion of V2I technology
- V2X technology
- On-demand service

Questions?