AUTOMATED BUS RAPID TRANSIT

Sustainable Fleet Technology Conference

New Horizons: AI and Autonomous Vehicles

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About Robocist

Established in 2015, our seasoned team brings decades of experience in transportation, engineering, artificial intelligence, and machine vision.

We believe the current era calls for a transformative approach to transportation, vehicles, infrastructure, and the strategies to maintain and upgrade our roadway network.

Our goal is to redefine and revolutionize these elements, paving the way for a more efficient and sustainable future in transport.

Consulting:

- Technology scouting
- Technology evaluation, planning & implementation
- Strategic Support

Data as a Service (DaaS)

- Roadway asset cataloging & assessments (pavement, road markings, signs, etc.)

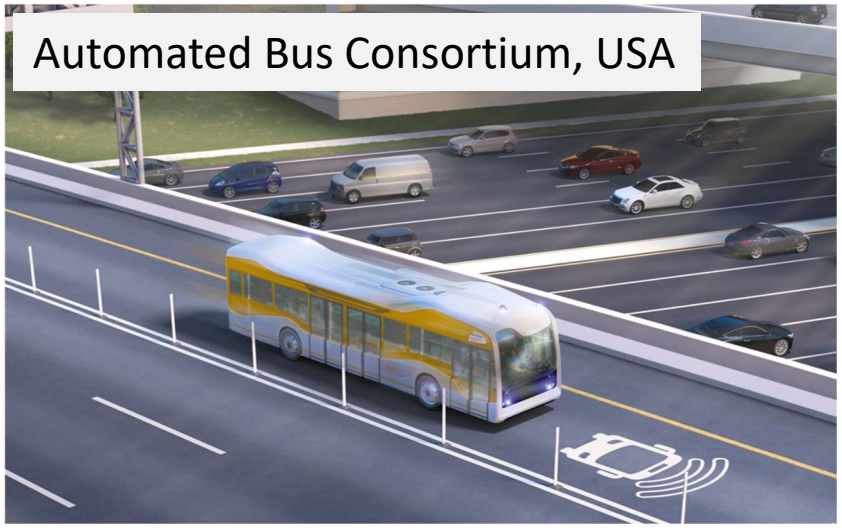
Focus Areas:

- Electric vehicles
- Autonomous vehicles
- Supporting infrastructure

Automated Bus Rapid Transit (ABRT)

A New Mode for High Quality, High-Capacity Transit Corridors

- Public focus on autonomous cars, trucks, and drones
- Buses represent a new opportunity
- Practical ways to apply current automated technology to transit
- Deployment is already underway globally
- Catalyst to reimagine the future of transport



Comparing Light Rail and Bus Rapid Transit

Accessibility Features (Both)

- Low floors in most LRT and BRT vehicles
- Level boarding for LRT and some BRT systems
- Compliance with Americans with Disabilities Act

Features of Bus Rapid Transit (BRT)

- Operate on both dedicated and shared roadways
- Typically faster than traditional bus transit
- Traffic signal priority/preemption
- Short headway bidirectional services

Characteristics of Light Rail Transit (LRT)

- Single or short train operation on fixed rails
- Power from overhead electric line
- Greater passenger capacity per operator
- Inflexible routes due to infrastructure requirements

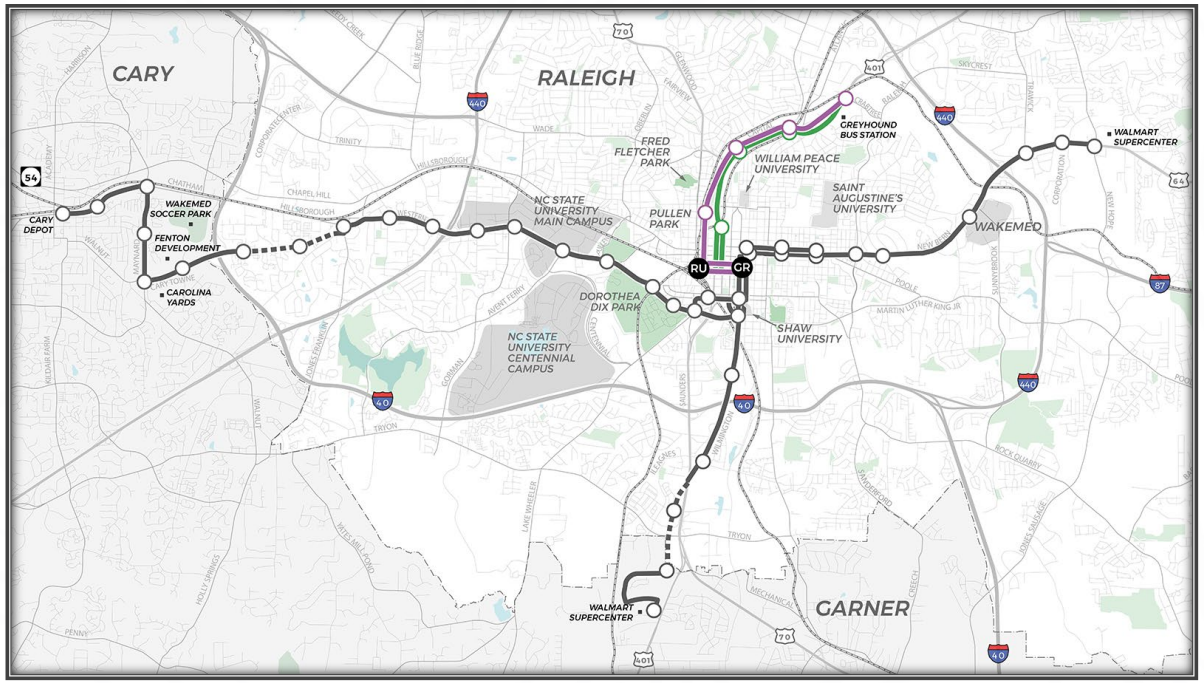
COMPARING LRT AND BRT (CONTINUED)

Comparison of LRT and BRT

- LRT - higher passenger capacity, higher infrastructure costs
- BRT - lower passenger capacity, lower infrastructure costs, and greater route/service flexibility

Infrastructure Considerations

- LRT – Require expensive trackwork and signals
- BRT - Use of conventional traffic signals, roundabouts, and intersections



Wake BRT: 20 miles of transit lanes along 4 BRT corridors in Wake County

EXPLORING AUTOMATED BUS RAPID TRANSIT (ABRT)

Leveraging autonomous vehicle technology to enhance BRT, making it competitive with LRT and improving traditional bus transit quality

BRT Enhancements:

- **Safety**: automated collision avoidance and emergency braking
- **Precision Driving**: automated lane-keeping for narrow rights-of-way and sharp turns
- **ADA Compliance**: automated precision docking for ADA-compliant gap and reduced bus and platform damage
- **Ride Quality:** automated smooth acceleration, deceleration, and speed control
- **Adaptability**: "platooning" to create electronically linked train of buses controlled by a single driver in the lead bus

Toyota IMTS Bus Platooning

SoftBank & JR-West ABRT Trials, Japan 2921

Using Automation to Assist, not Replace, Drivers

Federal Transit Administration (FTA)
Strategic Transit Automation Research (STAR) Plan

> "BRT service without a driver on board the vehicle"

Practical vision for Automated BRT:

- Support, not remove the drivers
  - Better, easier vehicle operation and flexibility
- Enable transit authorities to:
  - Transport more passengers
  - Increased safety
  - Improved comfort
  - Simplified accessibility for mobility impaired

We will be posting ABRT whitepapers under "Resources" on our website shortly: ww.Robocist.com

Kansas City Area Transportation Authority
Prospect MAX BRT

AUTOMATED PRECISION DOCKING

Better Positioning at Elevated Bus Stops

- Level boarding at all doors
- Reduce the gap between platform and bus
- Improved accessibility and service for mobility impaired community
- Fewer boarding and aligning incidents
- Reduce damage to buses and platforms compared to manual docking
- Supports bus yard automation
- Reduces driver stress
- Saves agency resources

KCATA: Kansas City, MO

AUTOMATED COLLISION AVOIDANCE & EMERGENCY BRAKING

Fewer Collisions

- Save lives
- Less injuries
- Reduces collision damage repairs
- Reduces insurance claims and premium
- Reduces driver stress
- Reduce spare bus ratio requirements
- Saves agency resources

Pierce Transit CAWS/AEB
FTA Safety Research and Demonstration Project

Automated Lane Keeping

Increase Roadway Useability

- Utilize narrower busways
- Use of shoulders for buses
- New ABRT corridors can be narrower with sharper curves
- Lower right-of-way acquisition and infrastructure cost
- Fewer sideswipe collisions
- Fewer mirror replacements

Automated Bus on Shoulder
Minneapolis, MN

AUTOMATED BUS PLATOONING / LEADER-FOLLOWER

Force Multiplier

- Increased passenger capacity on high volume routes
- Increased flexibility to adjust passenger capacity based on demand forecasting
- Increase bus capacity without increasing operators
- Improved fleet optimization
- Improve passenger to driver ratio

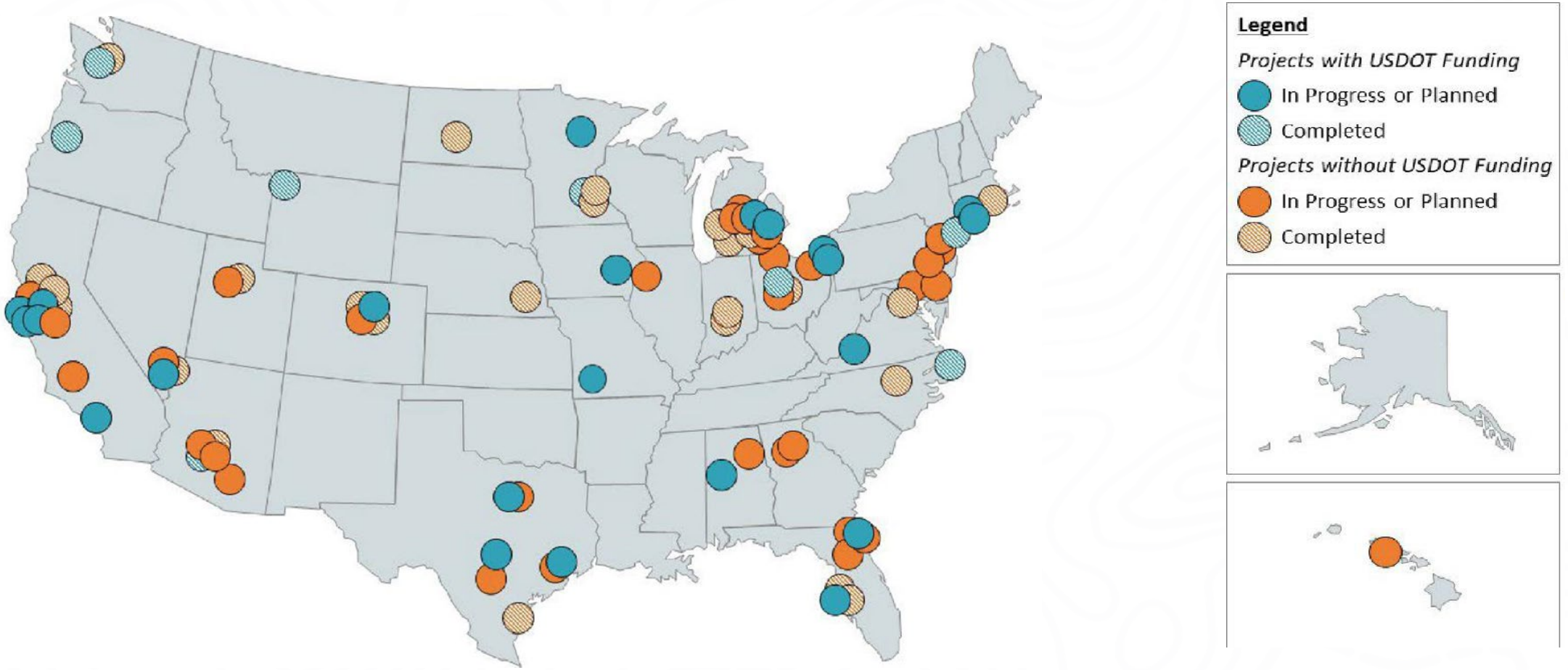
PANYNJ Exclusive Bus Lane
Weehawken, NJ

U.S. Transit Bus Automation Testing Activities

Federal Transit Administration (FTA)

Transit Bus Automation Quarterly Update (Q2 2023)

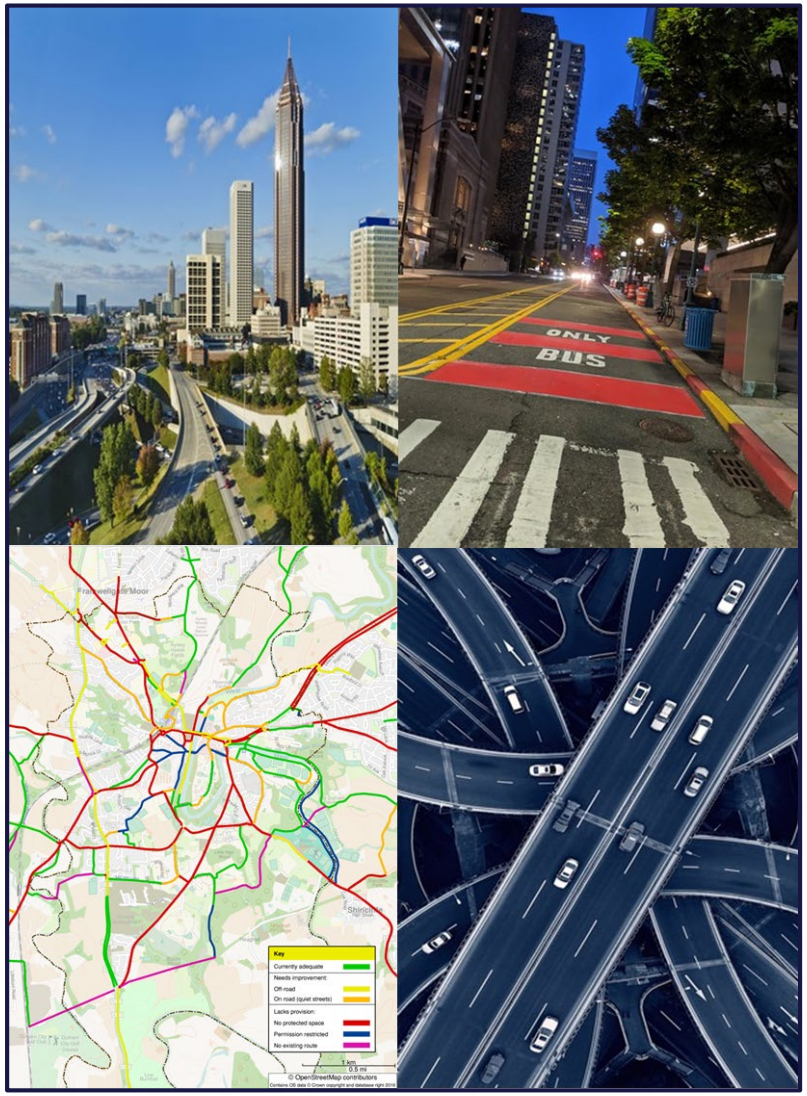
https://www.transit.dot.gov/research-innovation/transit-bus-automation-quarterly-update-q2-2023



INCORPORATING ABRT INTO THE PLANNING PROCESS

BRT Deployment – Great First Step

- Explore utilizing LRT corridors for ABRT implementation
- Plan for high performance, high-capacity transit corridors
- Comparison of costs, service, and environmental impacts for alternative modes: Bus, BRT, ABRT, LRT
- Development of ABRT costs and benefits plans
- Consider long range impact of ABRT adoption as a catalyst for a new business ecosystem
- Work with technology agnostic experts for early adoption



My crystal Ball: A vision for 2030 and Beyond

- Centralized dedicated AV arteries / highways
- First mile / last mile
  - Local lead vehicle pick-up
  - Robotaxis (San Francisco, CA: Cruise & Waymo)
  - Mobility impaired and senior support
- Off-peak vehicle applications: goods transport and delivery services
- Disaster response: evacuation, power redistribution, supply transport
- Calling all entrepreneurs - New market platform comparable to apps on phones:
  - Thriving entrepreneurial ecosystem
  - Telehealth, telelearning, remote work, immersive VR shopping, entertainment


ROBOCIST
Transforming the Driven Environment
Thank You
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