Thank you to the SMARTER Center and Morgan State University for hosting the Maryland Connected & Automated Vehicle Working Group!

Networking Breakfast Provided by the SMARTER Center.

Agenda

MARYLAND DEPARTMENT OF TRANSPORTATION

MARYLAND DEPARTMENT OF TRANSPORTATION

Maryland Connected & Automated Vehicles Working Group

May 21, 2025

Agenda

MOTOR VEHICLE ADMINISTRATION

Chrissy Nizer

Administrator

Maryland Department of Transportation

Motor Vehicle Administration

Governor's Highway Safety Representative

Co-Chair of the Maryland Connected & Automated Vehicles Working Group

cnizer@mdot.maryland.gov

MARYLAND DEPARTMENT OF TRANSPORTATION

MORGAN STATE UNIVERSITY

Mansoureh Jeihani, Ph.D., PTP
Morgan State University
Professor & Director
National Transportation Center
SMARTER Center
mansoureh.jeihani@morgan.edu

MARYLAND DEPARTMENT OF TRANSPORTATION

Transportation-as-a-Service (TaaS) for Autonomous Public Transit

Paula Bejarano

Senior Vice President for

Business Development & Sales

BENTELER Mobility

paula.bejarano@benteler-mobility.com

MARYLAND DEPARTMENT OF TRANSPORTATION

BENTELER
Mobility

Autonomous Solution for Public Transit

BENTELER
Mobility

BENTELER Group

BENTELER
MOBILITY

We are a global industrial player with 150 years of innovation in the mobility sector…

1876 Founded	**9bn$+** Revenue	**80+ years** Automotive Industry
100 Locations	**27k+** Employees	**27** Countries

Engineering quality
~2.500 patents for critical vehicle components

Supplier network
26k+ partners in supplier network

Launch speed
<2 months time from foundation to SOP

Adaptable production
80+ production sites globally

Financial strength
~5bn balance sheet assets

Process excellence
>50mn parts processed annually

…, with industrial **excellence** in **engineering, sourcing** and **production**

Enabled through our comprehensive industrial capabilities, we successfully transformed into a smart mobility provider

INDUSTRY & ENERGY

Rooted in steel & tube applications

AUTOMOTIVE

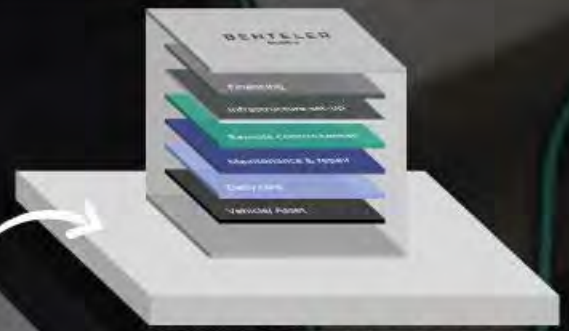
Being a tier-1 automotive supplier

BENTELER EDS[1]

Developed an integrated electric drive system

HOLON
a BENTELER company

Producing an autonomous people mover



BENTELER
MOBILITY

Providing required autonomous mobility services

1.) BENTELER Electric Drive System

BENTELER
Mobility

The Ecosystem: BENTELER Mobility

Passengers need

Availability
high coverage

Safety
superior to human

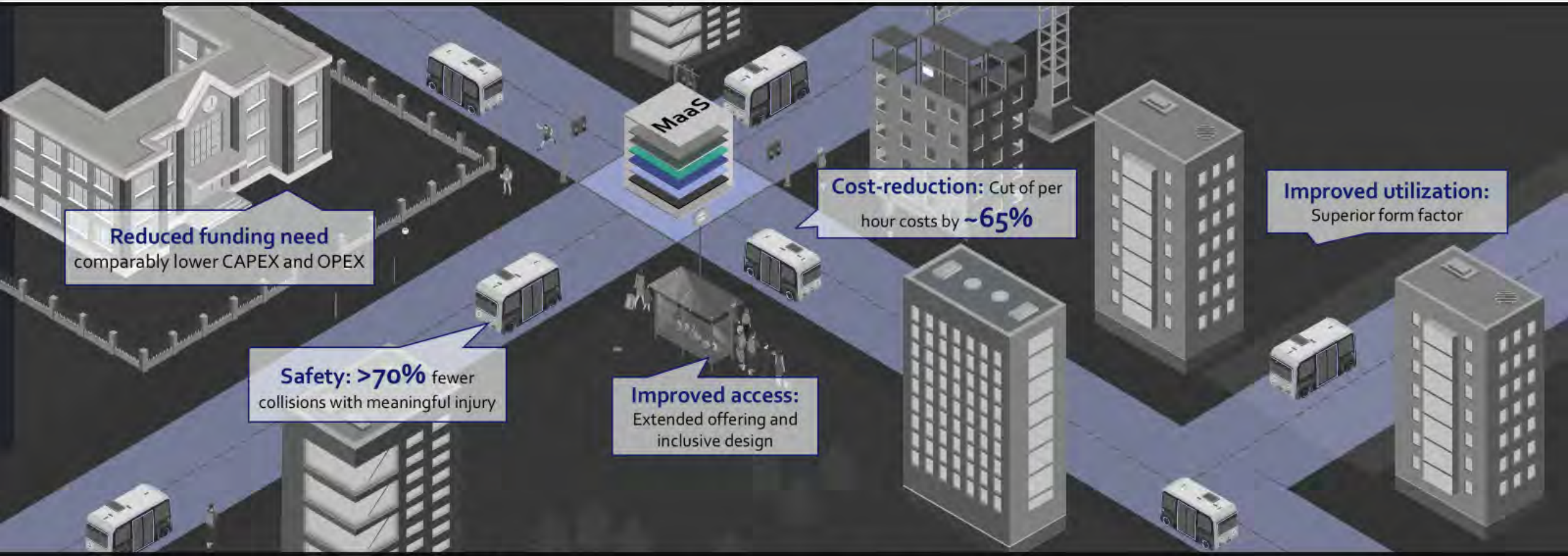
Comfort
in vehicle operation

Transportation Providers
require

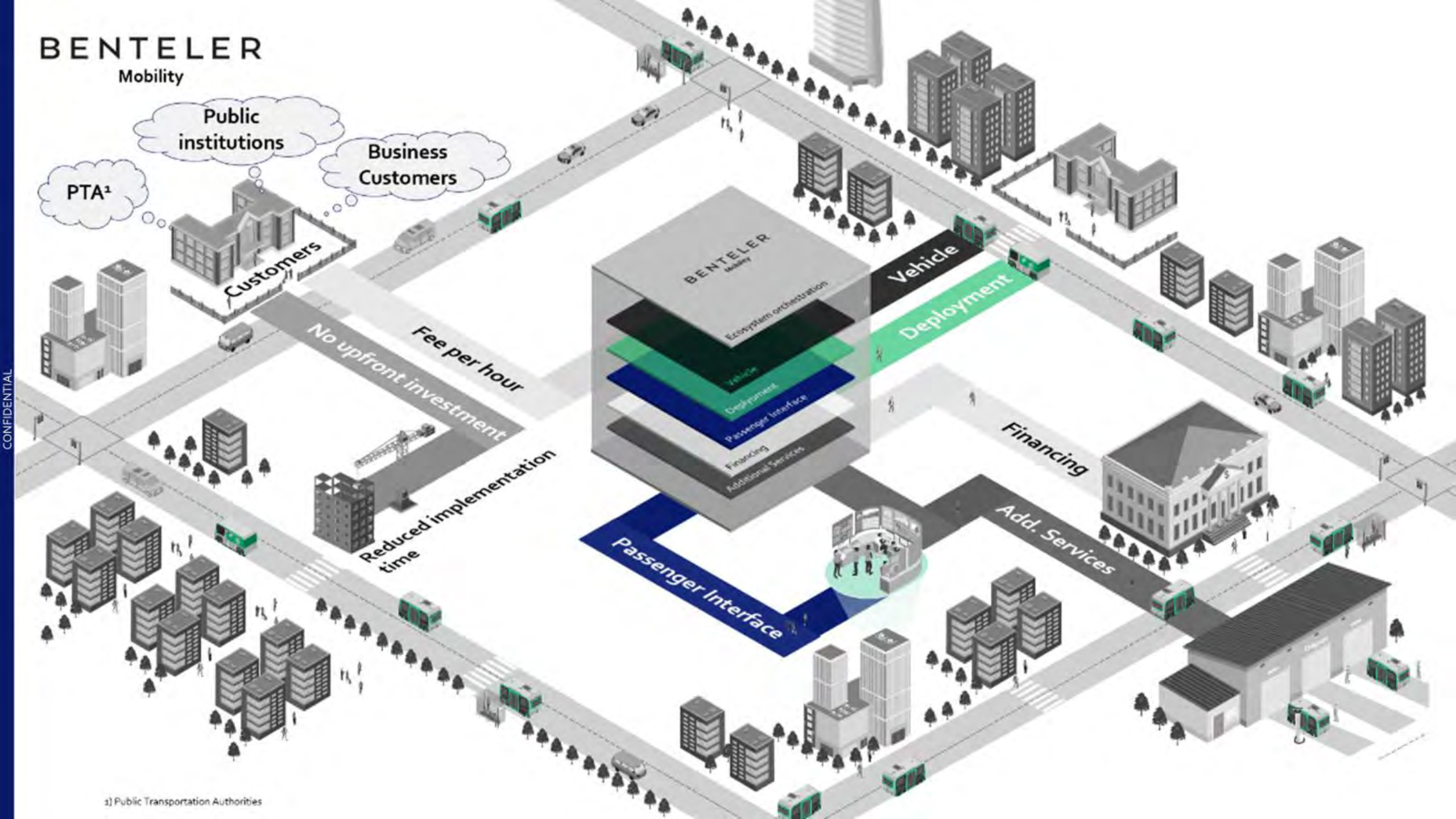
Low costs
self-funded PT

Asset-light
low capital intensity

Centrality
all-in-one solution



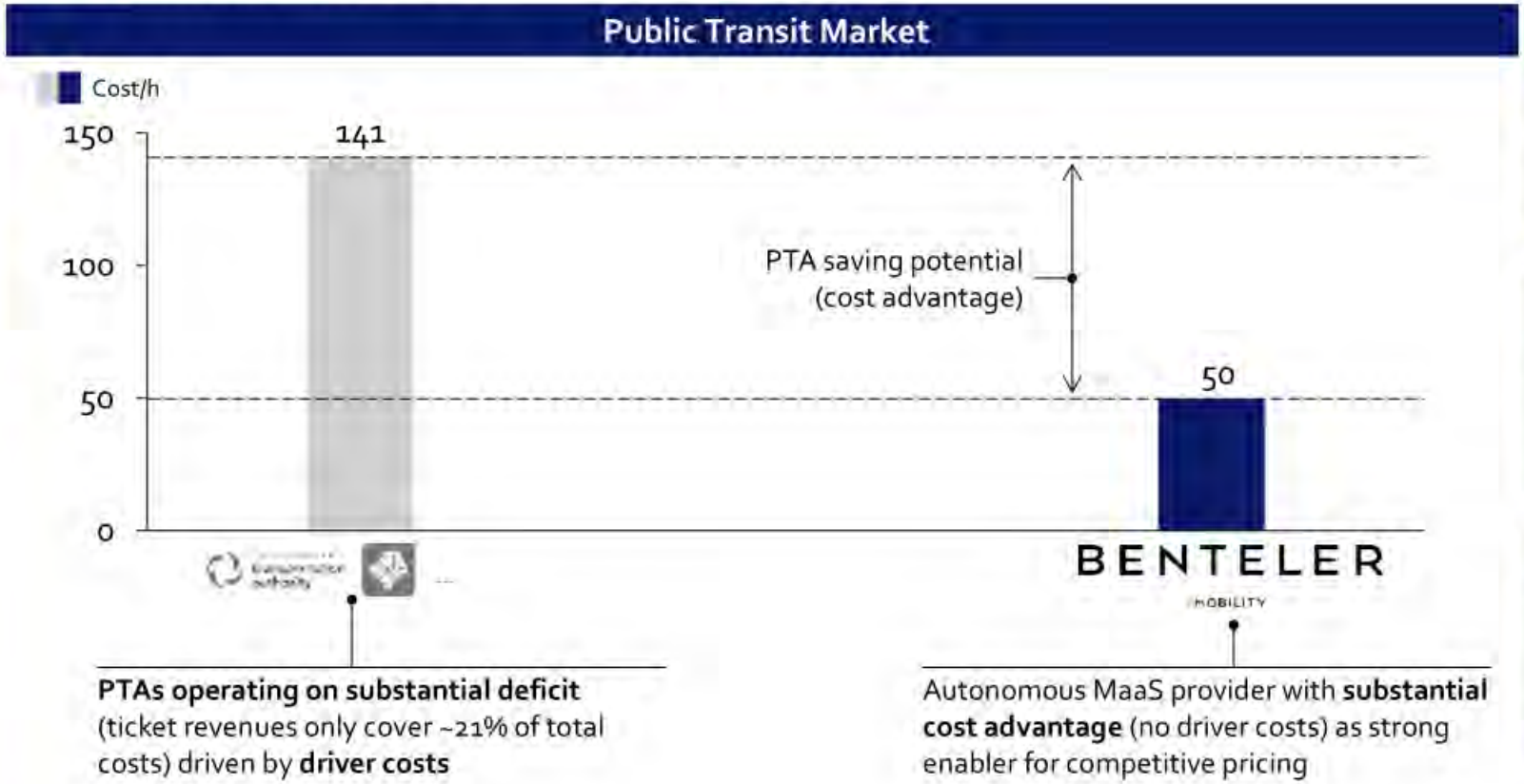
MaaS for public transit as the **key** in the transition to the future of urban mobility



1) Public Transportation Authorities

Autonomous Mobility-as-a-Service as the key enabler to reduce costs of public transit systems

Cost breakdown [values in USD]



PTAs operating on substantial deficit (ticket revenues only cover ~21% of total costs) driven by **driver costs**

Autonomous MaaS provider with **substantial cost advantage** (no driver costs) as strong enabler for competitive pricing

Source: SSCo Research

Benefits of BENTELER Mobility offering

Operating cost efficiency: Bundling of services and large scale of BENTELER Mobility fleet achieves overall cost advantage.

Asset light: Vehicle financing eliminates the need for high upfront investments and keeps assets off the balance sheet, enhancing financial flexibility.

One contract: Customers make one contract with BENTELER Mobility (BM handles subcontracts) which reduced complexity and implementation time.

BTI financing capabilities enable asset-light solutions for mobility operator

BENTELER
TRADING INTERNATIONAL

Global expert in structured finance business with focus on asset-light

3.5 bn$ AUM	**15+** funder	**28** countries	**14** customers & mandates

Proven Business Model

BTI's inventory and asset solutions provide an external balance sheet to any scale, at costs below WACC. As one of few global providers BTI offers **asset-light** models – with a particular focus on mobility solutions.

Unique Funding Access

BTI is capable of **financing large transactions** through its **global banking relationships** with funders who participate in BTI's structures.

International Presence

BTI and the Group operate in **28 countries across 100 locations**. BTI has offices in the UK, Switzerland and the US with a particular focus on the Americas and Europe (global asset flows across all regions, incl. ME, APA).

Strong Retention

BTI has a **100% retention rate**, with clients ranging from investment to large sub-investment grade companies. **Clients** have a **concentration** in the **Automotive** and **TMT industries.**

HOLON

Our Mover is equipped with exceptional product features, positioning HOLON ahead of competition

The HOLON Mover

- **27 sensors** around vehicle (Lidar, Radar, Cameras)
- **37 mph** Top Speed
- **SDS system** provided by *MobilEye*
- Battery **electric** vehicle with **110 kWh/ >7hrs** continuous **operating time**
- Automatic **ADA-compliant Wheelchair Ramp** & Restraints
- **Transit Class:** Gross weight 10,582 lbs
  Curb weight 7,936 lbs:

- Produced according to US **automotive grade standards**

In-Cabin Monitoring & Passenger Personalization

Revenue Generating
Targeted advertising platform commands premium CPM rates

Customizable infotainment system

Flexible Interior
9 seated + 6 standing capacity as shown

Passenger Management
AI-enabled in-cabin monitoring for passenger safety, medical emergencies, uncivil behavior and 2- way communication

Remote Supervision
Cloud interface to enable remote monitoring of vehicle activity and parameters

Vehicle Prototype 1 – Series Model






HOLON

[HOLON Vehicle Testing_Snow]

HOLON's First Manufacturing Plant – Jacksonville, Florida

Land Size: **41 acres**

Investment: **> $100,000,000**

New Jobs: **> 150 (1-shift)**

Total Value Chain Jobs: **> 1,000**

Building: **500,000 sqft**

Annual Production: **5,000 (1-shift)**

Developer: **VanTrust**

HOLON

At the Forefront of Regulatory & Safety Compliance

HOLON's mover is designed to excel in public road use by setting new benchmarks in safety, ride comfort and production quality.

The mover is being developed in close collaboration with authorities to ensure it complies with relevant federal requirements, including Buy America and Federal Motor Vehicle Safety Standards (FMVSS), upon deployment.

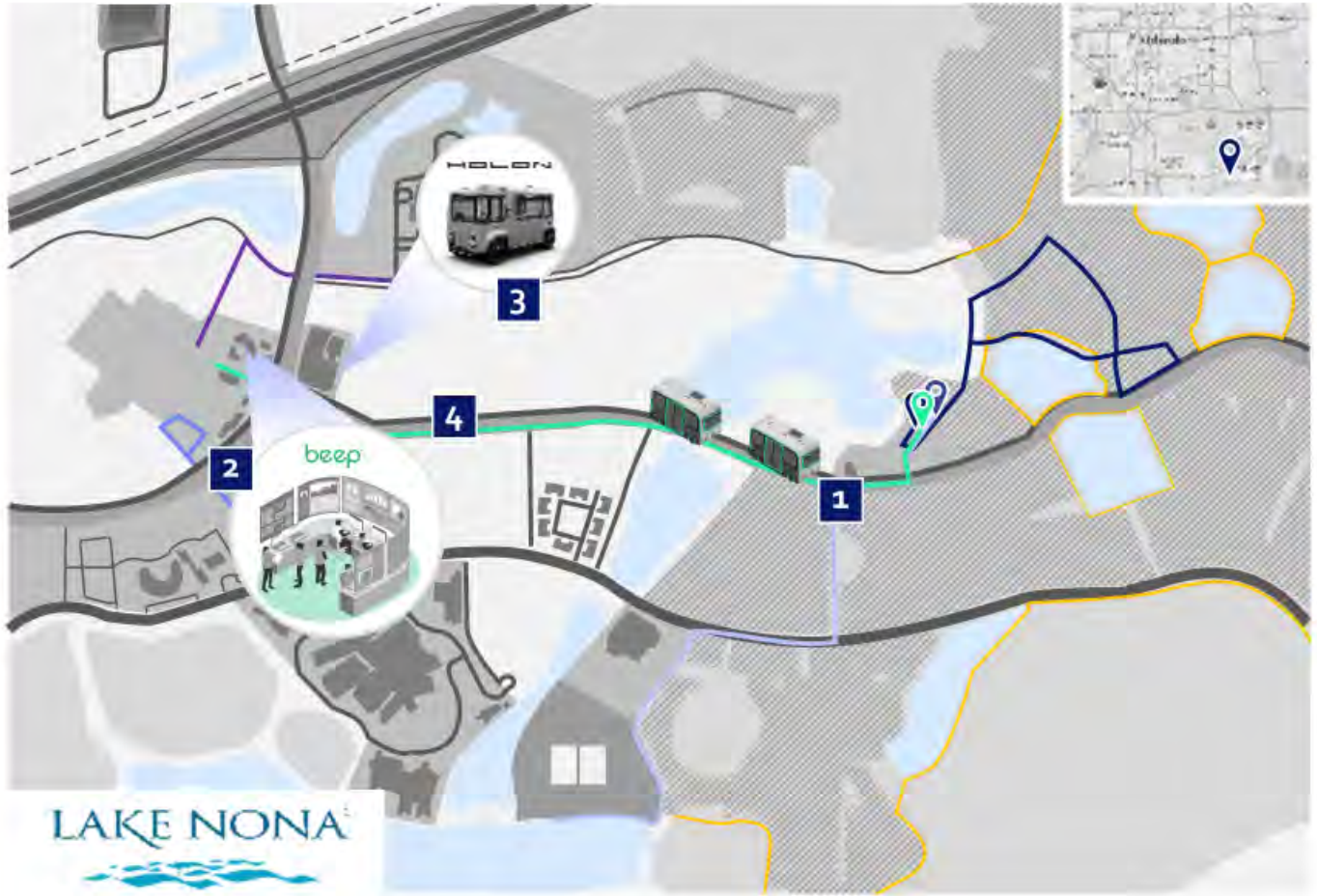
Link to Vehicle Testing Video

HOLON

BENTELER
Mobility

Commercial Deployment

Autonomous Operations in Lake Nona Master-Planned Community, Orlando FL



Autonomous Mobility Experience in Lake Nona

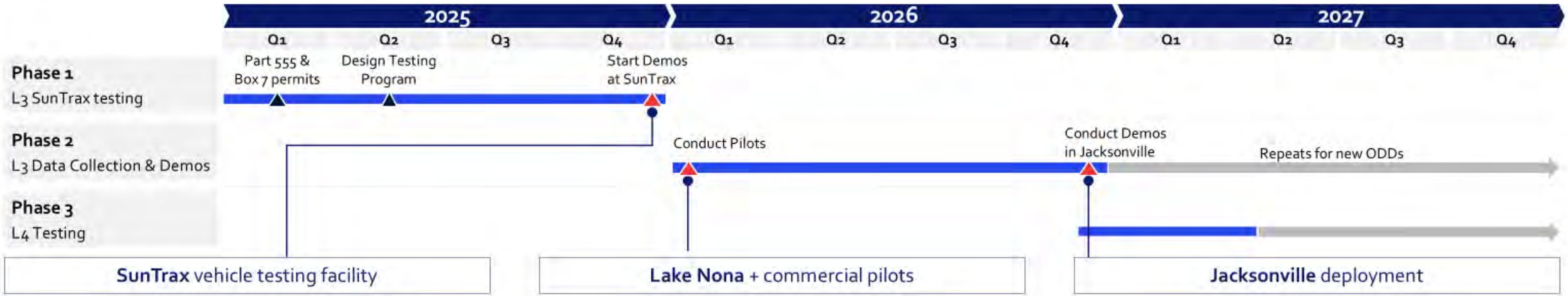
1 **TEST DRIVE**
Driving event in autonomous shuttle with Mobileye SDS on special routes through Lake Nona

2 **CONTROL CENTER TOUR**
Exploration of beep autonomous driving control center with demonstration of autonomous OS

3 **HOLON MOVER DEMO**
Interactive demo of HOLON Mover capabilities combined with show-car visit

4 **BUSINESS MODEL EXPLORATION**
Discussion and analysis of business models for re-financing of autonomous mobility service offerings

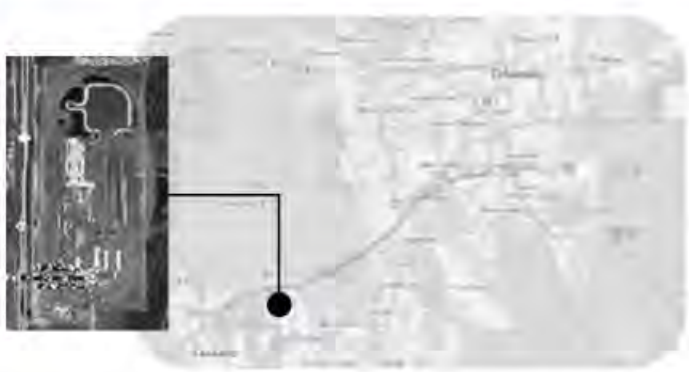
Our go-to-market strategy from closed loop testing to open road deployment



SunTrax vehicle testing facility

Lake Nona + commercial pilots

Jacksonville deployment



Conducting private road testing of prototypes

Scaling testing to real-life environments

Commercial vehicle operations

Awarded autonomous mobility pilot in Jacksonville as lighthouse project for roll-out on east coast

US market entry via tender process

First Mover in autonomous MaaS

JACKSONVILLE TRANSPORTATION AUTHORITY

JTA Tender Award

BENTELER MOBILITY

beep™

- BENTELER Mobility and partners handed-in **160-page tender request** for 1st autonomous public transit system for U2C project in Jacksonville
- Jacksonville Transportation Authority (JTA) **awarded BENTELER Mobility and partners**
- **Project scope: Price and margin is fixed** and will be the standard for upcoming tenders
- HOLON builds first **build-to-suit series production site** in Jacksonville

Expanding and securing market position

APTA American Public Transportation Association

ACES MOBILITY COALITION

BENTELER MOBILITY

- With active **membership** in the **APTA** and **ACES, BENTELER Mobility shapes** conditions for the successful roll-out of auton. **mobility in the US**
- **Texas, Florida and Georgia** confirmed that they **bypass tenders** for autonomous vehicle solutions based on JTA award - **New York, Illinois, California and Arizona** likely to **follow**

CONFIDENTIAL

Thank You!

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Disclaimer and contact information

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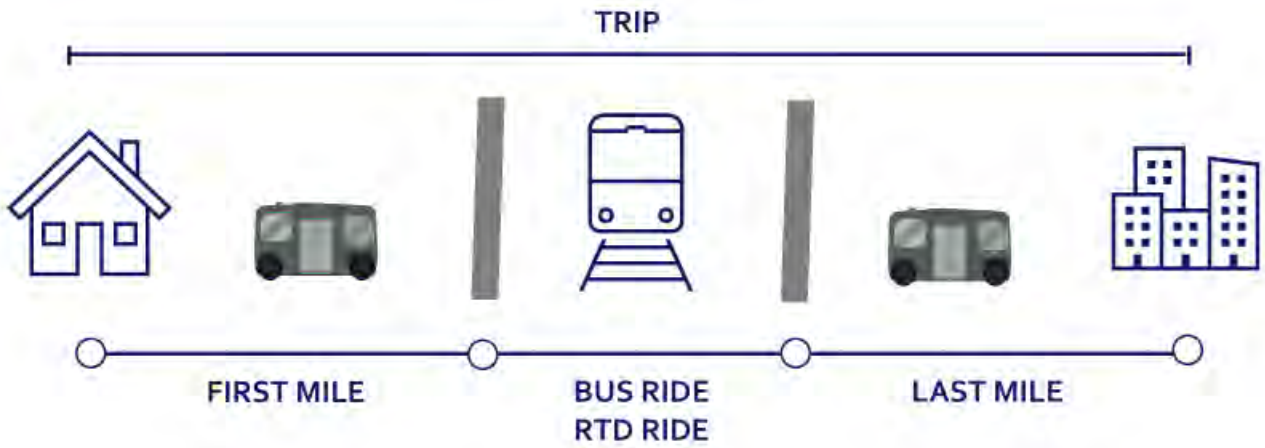
Benteler Trading International AG

Baarerstrasse 131

6300 Zug – Switzerland

One of our main use cases to pilot will be a first & last mile autonomous transit solution



Pilot Specifications

- Total duration: 6 – 12 months
- Schedule: 5 days per week (Mon-Fri)
- Hours: 8am – 6pm
- Flexible # of stops
- Maximum road speed: 35 mph
- Urban/suburban routes

Operations Setup

- DC fast charger (90kWh batteries)
- Secured overnight parking
- Space for cleaning, maintenance & repair, data offloading

We support our customers with all the necessary tasks to run a successful pilot:

Vehicle supply → Deployment → Operations → User Interface

Transportation-as-a-Service (TaaS) for Autonomous Public Transit

Paula Bejarano

Senior Vice President for

Business Development & Sales

BENTELER Mobility

paula.bejarano@benteler-mobility.com

MARYLAND DEPARTMENT OF TRANSPORTATION

Short Break

Next up is Dr. Sivashankar Sivakanthan, Ph.D.
The Future of Accessible Autonomous Transportation

Agenda

MARYLAND DEPARTMENT OF TRANSPORTATION

The Future of Accessible Autonomous Transportation

Sivashankar Sivakanthan, PhD
University of Pittsburgh
sis65@pitt.edu

MARYLAND DEPARTMENT OF TRANSPORTATION

Make it American Program
NEMA – National Electronics Manufacturers Association

Steve Griffith, PMP

Executive Director, NEMA

Regulatory & Industry Affairs, Mobility

MARYLAND DEPARTMENT OF TRANSPORTATION

NEMA

MAKE IT AMERICAN™

Who We Are

The National Electrical Manufacturers Association (NEMA) is proud to represent over 300 leading manufacturers of electrical equipment technologies.

Collectively, our members contribute 1% of U.S. GDP, employ nearly 460,000 Americans in every state, and generate over $250 billion annually for the U.S. economy. Learn more at www.nema.org

Make it Electric

NEMA's Sector-Based Strategy

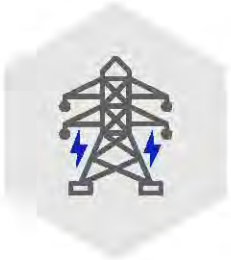
As part of our growth strategy, we focus on strategies that drive member value across four key end-market verticals: **Built Environment, Mobility, Grid,** and **Industrial/Core.**

Built Environment

- Smart Lighting
- Connected Systems
- Energy Efficiency
- Health & Wellness

Mobility

- EVs and Charging Infrastructure
- EV Components
- Connected & Autonomous Transportation
- Bi-Directional Charging



Grid

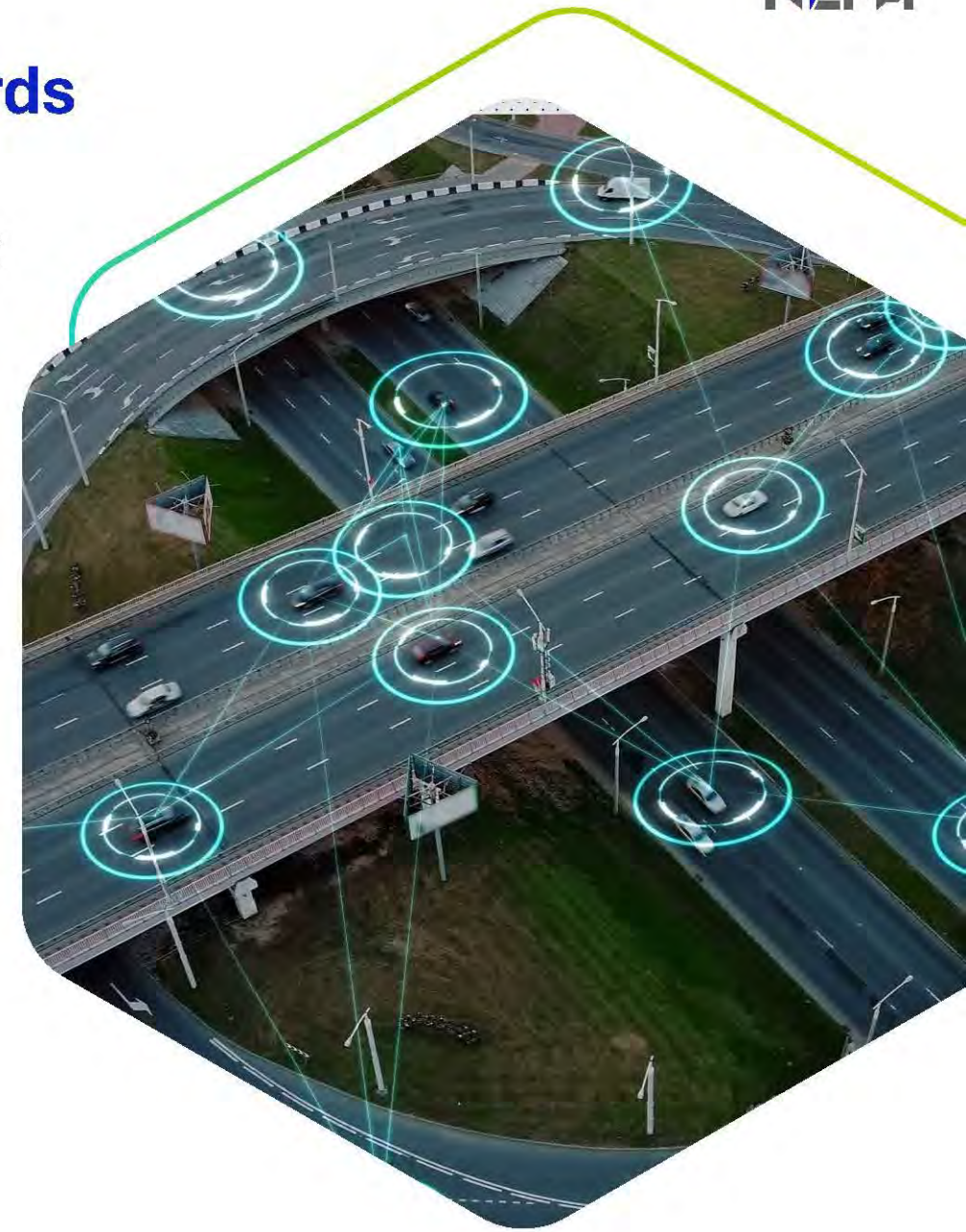
- Renewable Energy Generation
- Energy Storage
- Demand Response
- Power Distribution
- Power Transmission

Industrial

- Industrial Automation
- Smart, Domestic Manufacturing
- E-Machinery
- Cybersecurity
- AI

NEMA Transportation Management Standards

Transportation management systems encompass the hardware, software, firmware, and integration services that enable intelligent transportation systems (ITS)



NEMA TS 40002
Traffic Controllers Assemblies with NTCIP Requirements

NEMA TS 40004
Variable Message Signs (VMS) and Dynamic Message Signs (DMS) with NTCIP Requirements

NEMA TS 40005
Portable Traffic Signal Systems (PTSS) Standard

NEMA TS 40008
Cyber and Physical Security for Intelligent Transportation Systems (ITS)

NEMA TS 40009
Advanced Traffic Performance Measures for Intelligent Transportation Systems (ITS)

NEMA TS 40010
Connected Vehicle Infrastructure—Roadside Equipment

NEMA's Make it American Program

Resource Center

- Guidance and Advocacy Tools
- Roadmaps
- On-Demand Legal Resources

Voluntary Certification

- Option to obtain to both Process Certification and BABA Product License(s) via third-party audit
- NEMA-licensed "NEMA Domestic Content" mark for a company, facility and/or product-level

Process Standard & Product Specifications

- 70901-2024 Process Standard: BABA Supply Chain Evaluation & Assurance Process *(applies to all manufacturers)*
- NEMA BABA Product Specification: Low Voltage Distribution Equipment
- NEMA BABA Product Specification: Wire & Cable

Government & Key Partner Outreach

- Federal and State agency officials
- Significant support and endorsement
- Industry leadership and government efficiency
- Public listing of NEMA-certified companies, facilities, and products

NEMA Make It American Program

Process & Product Certification

Organizations opt to certify process and/or products

Third-party expert audit to determine company's conformance to supply chain evaluation process standard and their application of product-specific criteria

Successful completion of audit(s) results in NEMA-issued certification mark(s) for use at company and product level

Enhances credibility and provides confidence for both companies and regulatory agencies

Program Certification & Licensing Marks

NEMA 70901-2024 Process Certification Mark

- Supply Chain Evaluation Process with Facility-level audit
- Facility and Corporate usage of mark

BABA Product License Marks

- BABA Product Specification audit and certification
- For use on corporate website, marketing materials, product packaging, etc.

NEMA to provide Branding Guidelines, marketing examples, recommendations, etc.

Leveraging Make It American™ for Broader Manufacturing Sector

Scalable Across Industries: NEMA's BABA Process Standard (70901-2024) is a flexible framework suitable for any U.S. manufacturing facility seeking to demonstrate domestic content.

Collaborative Expansion: Forge partnerships with trade associations and manufacturers in adjacent sectors to broaden adoption and increase market penetration.

Standards Leadership: Utilize NEMA's role as a Standards Development Organization (SDO) to create new BABA product specifications tailored to diverse manufacturing categories.

Amplified Market Impact: Work with federal agencies and stakeholders to drive broader recognition and acceptance of Make It American™ certification marks across procurement and supply chains.

Contacts

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Make it American Program
NEMA – National Electronics Manufacturers Association

Steve Griffith, PMP

Executive Director, NEMA

Regulatory & Industry Affairs, Mobility

MARYLAND DEPARTMENT OF TRANSPORTATION

University Updates

Morgan State University
University of Maryland
Johns Hopkins University

MARYLAND DEPARTMENT OF TRANSPORTATION

MORGAN STATE UNIVERSITY

Mansoureh Jeihani, Ph.D., PTP
Morgan State University
Professor & Director
National Transportation Center
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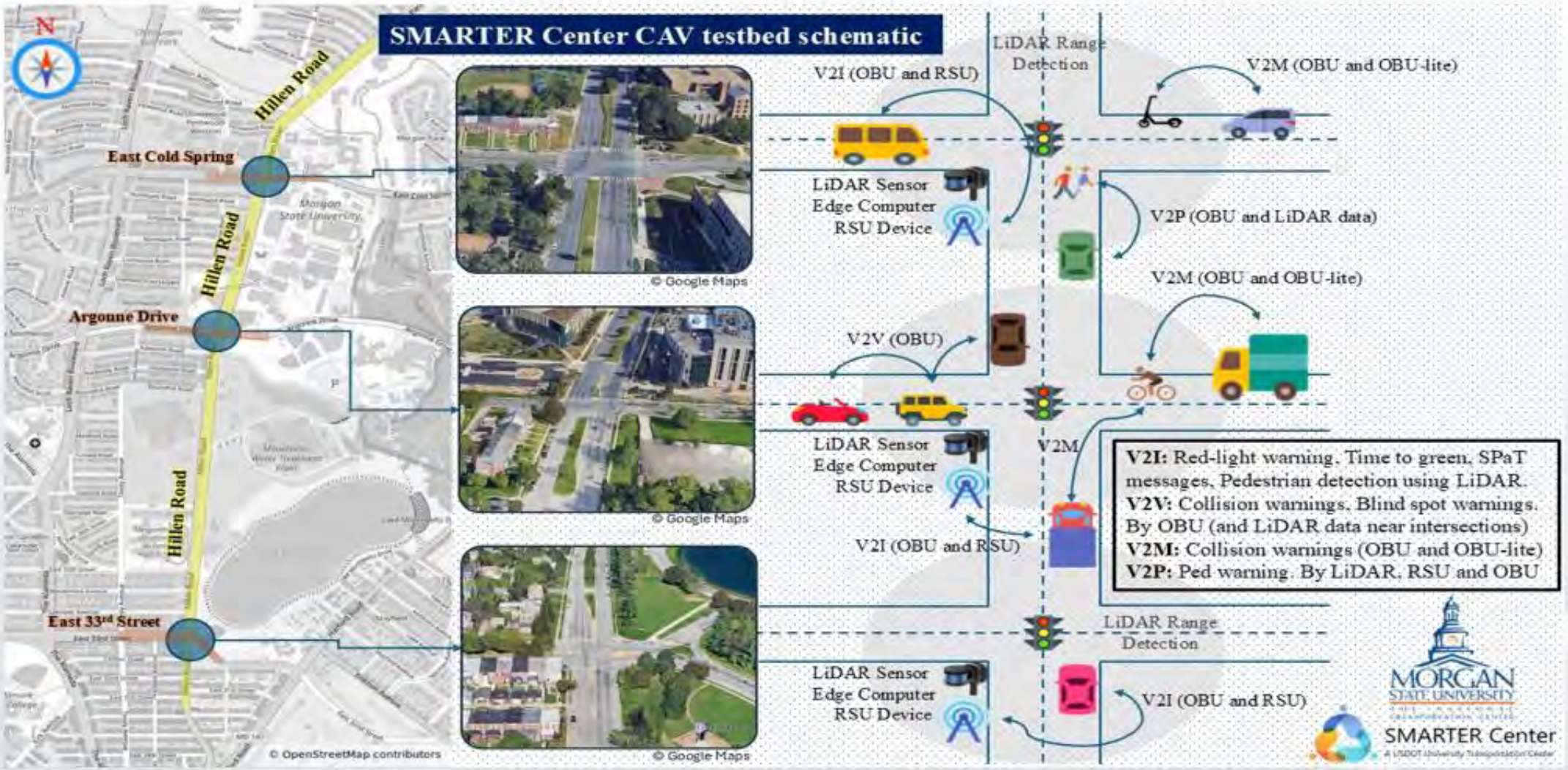
MARYLAND DEPARTMENT OF TRANSPORTATION

Morgan STATE CAV Updates
SMARTER Center

SMARTER Symposium

CAV Testbed


SMARTER Center CAV testbed schematic
N
Hillen Road
East Cold Spring
Hillen Road
Argonne Drive
Hillen Road
East 33rd Street
Morgan State University
© OpenStreetMap contributors
© Google Maps
© Google Maps
© Google Maps
LiDAR Range Detection
V2I (OBU and RSU)
V2M (OBU and OBU-lite)
LiDAR Sensor
Edge Computer
RSU Device
V2P (OBU and LiDAR data)
V2M (OBU and OBU-lite)
V2V (OBU)
LiDAR Sensor
Edge Computer
RSU Device
V2M
V2I (OBU and RSU)
V2I: Red-light warning. Time to green. SPaT messages. Pedestrian detection using LiDAR.
V2V: Collision warnings. Blind spot warnings. By OBU (and LiDAR data near intersections)
V2M: Collision warnings (OBU and OBU-lite)
V2P: Ped warning. By LiDAR, RSU and OBU
LiDAR Range Detection
LiDAR Sensor
Edge Computer
RSU Device
V2I (OBU and RSU)
MORGAN STATE UNIVERSITY
SMARTER Center

Autonomous Wheelchair

National Transportation Center / SMARTER Center

- Linktree: https://linktr.ee/NTCMorgan
- NTC Website: https://www.morgan.edu/soe/ntc
- SMARTER Website: https://smartercenter.org/

- Twitter: @NTCMorgan
- Facebook: @MorganTransportationResearch
- LinkedIn: National Transportation Center at MSU

MORGAN STATE UNIVERSITY

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MARYLAND DEPARTMENT OF TRANSPORTATION

UNIVERSITY OF MARYLAND

Keveh Forkhi Sadabadi

For Tom Jacobs and Terry Yang

University of Maryland

Center for Advanced Transportation

Technology Transfer Center

MARYLAND DEPARTMENT OF TRANSPORTATION

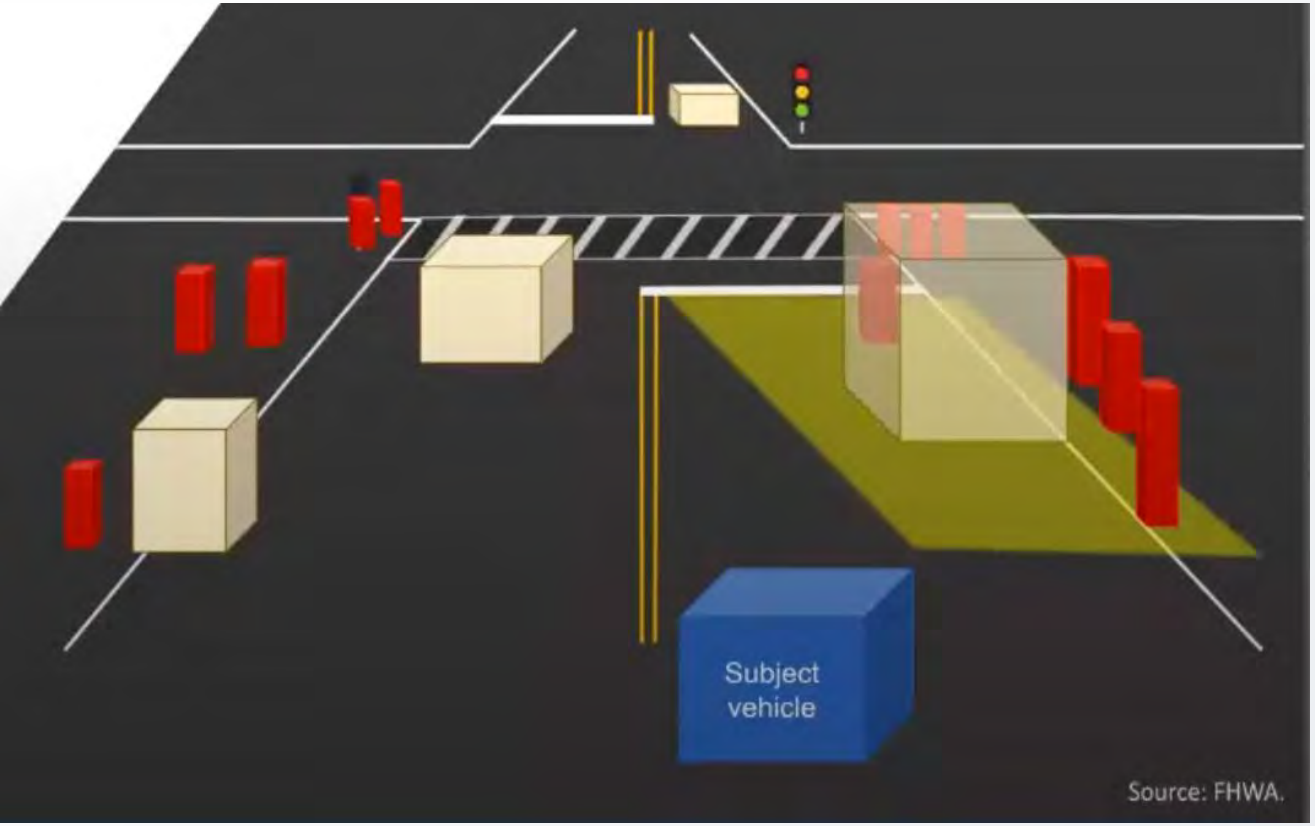
Development of a Pedestrian Collision Avoidance System for Connected and Autonomous Vehicles with Cooperative Perception

Terry Yang
University of Maryland

Presented by Tom Jacobs

UNIVERSITY OF MARYLAND

Detection Challenges: “Blind Spot”



Cooperative Perception

Cooperative Perception (also known as collective perception) refers to the concept where multiple connected vehicles and infrastructure (such as roadside sensors or cameras) share their real-time perception data to improve situational awareness and safety. This is particularly useful in situations where an individual vehicle’s sensors may be obstructed or have limited range.

Cooperative Protection Demo - Ped

Case 1:
CAV reacts to a pedestrian
No-Cooperative Protection is needed

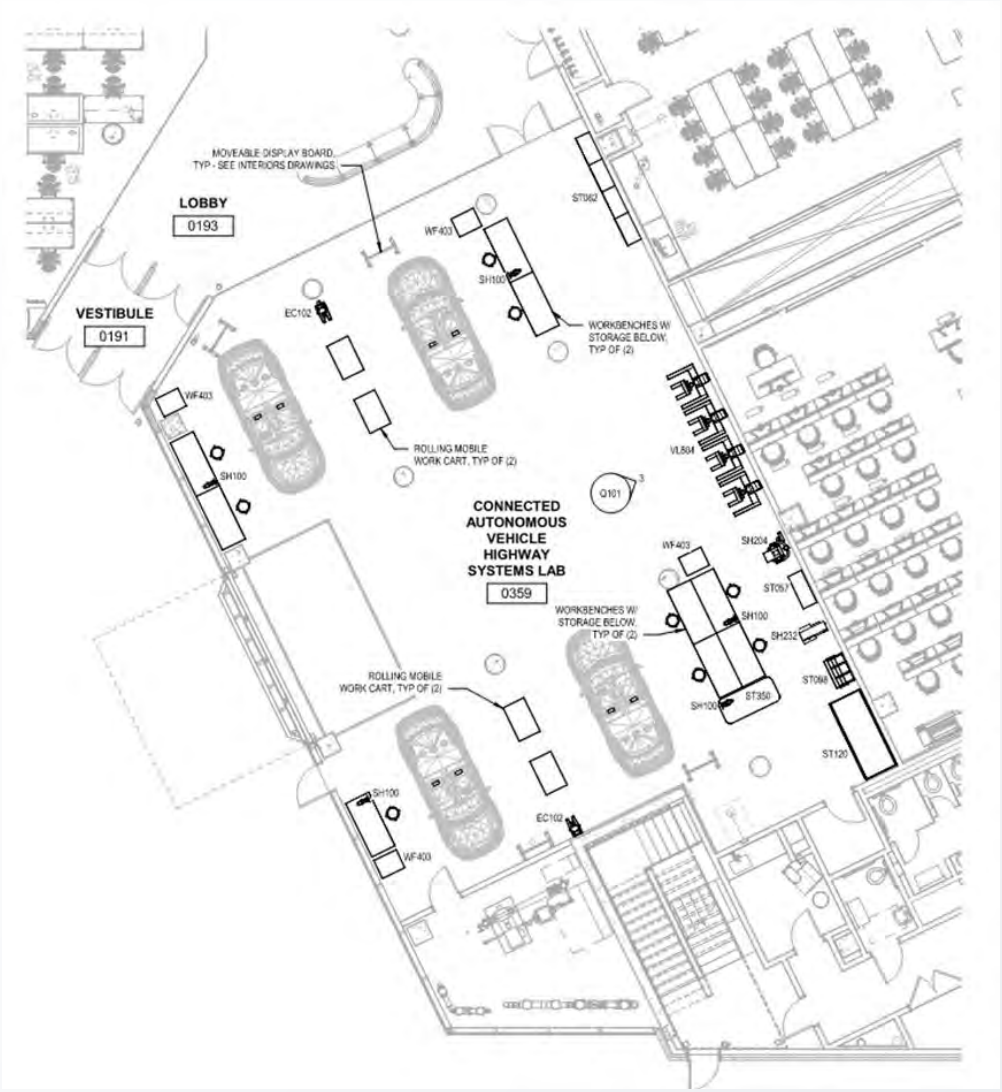
Cooperative Protection Demo - Ped

Case 2:
CAV crashes into pedestrian
Cooperative Protection is not placed

Cooperative Protection Demo - Ped

Case 3:
CAV stops before hitting pedestrian
CP is placed and ped behavior prediction

Zupnik Hall / CAV Lab Construction


MOVEABLE DISPLAY BOARD, TYP - SEE INTERIORS DRAWINGS
LOBBY
0193
VESTIBULE
0191
WORKBENCHES W/ STORAGE BELOW, TYP OF (2)
ROLLING MOBILE WORK CART, TYP OF (2)
CONNECTED AUTONOMOUS VEHICLE HIGHWAY SYSTEMS LAB
0359
WORKBENCHES W/ STORAGE BELOW, TYP OF (2)
ROLLING MOBILE WORK CART, TYP OF (2)


MEETING
269 SF
LEGACY DISPLAY ROOM
1672 SF
CONF. ROOM
400 SF
DIR. OFFICE
139 SF
OFFICE
143 SF
HUDDLE
139 SF
HUDDLE
143 SF
STORAGE
STORAGE
CC
ELECTRIC
IDF
OPEN TO BELOW
FIELD SAMPLE PROCESSING LAB
1903 SF
(2630 SF)
LOADING
627 SF
(500 SF)
INTELLIGENT INFRASTRUCTURE LABORATORY
1229 SF
(1200 SF)
OPEN TO BELOW
CONNECTED AUTONOMOUS VEHICLE HIGHWAY SYSTEMS LAB
3494 SF
(3356 SF)
BIM / VIRTUAL DESIGN LAB
3477 SF
(3900 SF)
FIRE PUMP
STAIR
LAC
93 SF
(100 SF)
ALL GENDER
HK
EM. POWER


SUNBELT RENTALS
JCB

UNIVERSITY OF MARYLAND

Keveh Forkhi Sadabadi

For Tom Jacobs and Terry Yang

University of Maryland

Center for Advanced Transportation

Technology Transfer Center

MARYLAND DEPARTMENT OF TRANSPORTATION

JOHNS HOPKINS UNIVERSITY

Anton “Tony” Dahbura, Ph.D.

Co-Director of the Johns Hopkins Institute for Assured Autonomy

Executive Director of the Johns Hopkins University Information Security Institute

atd@hublabels.com

MARYLAND DEPARTMENT OF TRANSPORTATION

Introducing the Johns Hopkins S4 Vehicular Communications Lab

S4 LAB

Research Initiative To Build
Safe, Secure, Smart, Scalable
Communications Infrastructure for
Vehicle-To-Everything Networks

Research Projects

Enhancing V2X Co-Verification with Machine Learning

- Integration of ML with a co-verification algorithm to address anomaly detection in V2X communications (detecting and mitigating falsified vehicular data).

Enhancing CAV Cybersecurity: Simulating Sybil Attacks and ML-Driven Detection and Revocation

- The Security Credential Management System (SCMS) has been developed to ensure the authentication and authorization of V2X messages while preserving user privacy with pseudonyms and digital signatures. However, SCMS is vulnerable to Sybil attacks, where adversaries exploit multiple valid pseudonym certificates to impersonate multiple vehicles within the network.

Network Coding for V2X Time-Sensitive Applications with Multipath Protocol

- Explores a Non-Binary Expander Code as an optimized solution for handling packet loss in V2X communications.

Seeing More With Less: Bandwidth-Conscious V2X Data Fusion for Cooperative Perception

- Introduces a novel fusion algorithm that enhances vehicular perception in V2X networks.

Workshop Announcement:

Enabling Our Autonomous Transportation Future: Accelerating Safe and Sustainable Mobility

- **September 9, 2025**, 8:00am-5:45 pm with reception to follow.
- Johns Hopkins Bloomberg Center, Washington, DC (555 Pennsylvania Avenue).
- Purpose: foster collaboration among distinguished academics, government leaders, and industry visionaries.
  - Share cutting-edge research and operational insights
  - Identify critical needs and best practices for safe and scalable adoption
  - Establish impactful partnerships across sectors.
- Contact to register: Ed Pavelka (JH APL)- Ed.Pavelka@jhuapl.edu
- Attendance is limited!

JOHNS HOPKINS UNIVERSITY

Anton “Tony” Dahbura, Ph.D.

Co-Director of the Johns Hopkins Institute for Assured Autonomy

Executive Director of the Johns Hopkins University Information Security Institute

atd@hublabels.com

MARYLAND DEPARTMENT OF TRANSPORTATION

Attendee Updates

Government – Federal, State, Local
Universities and Colleges
Companies and Organizations
Other

MARYLAND DEPARTMENT OF TRANSPORTATION

Adjourn

MSU – Demos in Atrium
Q&A with Benteler – Remain in Auditorium

cavmaryland@mdot.state.md.us

Cav.Maryland.Gov

MARYLAND DEPARTMENT OF TRANSPORTATION

Transportation-as-a-Service (TaaS) for Autonomous Public Transit

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BENTELER
Mobility

Autonomous Solution for Public Transit

MARYLAND DEPARTMENT OF TRANSPORTATION