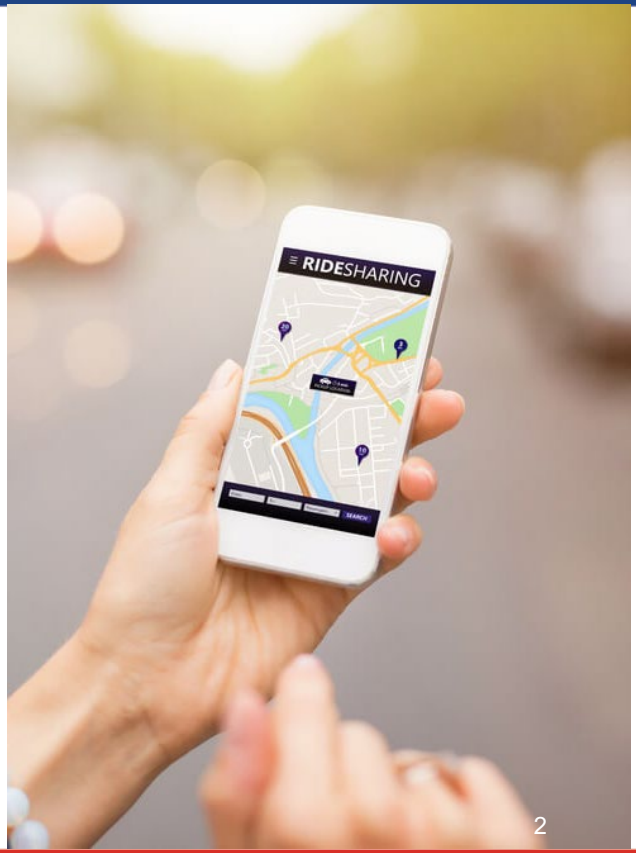
Are We There Yet?

Our Journey to Safe and Smart Mobility

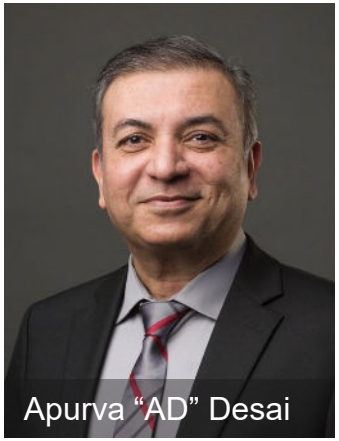
FAV Summit | September 8, 2023

Welcome



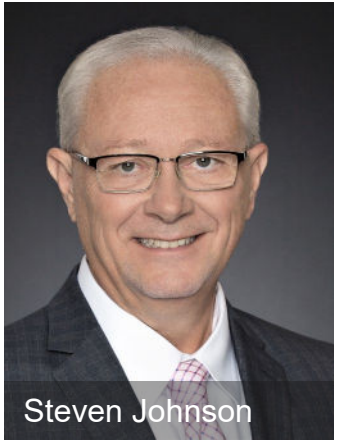
Presenters and Panelists


Bernard Arseneau


Apurva “AD” Desai


Michael Hunter


Sgt Robert Dooley


Steven Johnson


Greer Johnson Gillis

Apurva “AD” Desai

Vice President of ITS

IntelliRoad, a division of Kyra Solutions, Inc.

Bridging the GAP to CV

A DISCUSSION FROM THE FRONTLINE

2023 FAV Summit – Tampa
presented by IntelliRoad – a division of Kyra Solutions

AD Desai
Vice President - ITS

FLORIDA AUTOMATED VEHICLES

FLORIDA'S TURNPIKE

IntelliRoad

Safe and Smart Mobility

A DISCUSSION FROM THE FRONTLINE

TOPICS WE WILL COVER

- Safety for All
- Redefining Connected
- Florida's Turnpike Enterprise - V2X-CV Safety Program
- Use Case Video Clips
- Technology-Agnostic Solution

IntelliRoad

SAFETY for ALL

A CALL TO ACTION

For a second consecutive year, preliminary estimates from the National Safety Council (NSC) indicate that in a single year's time – more than 46,000 people lost their lives in traffic crashes.

Compared to pre-pandemic 2019, the mileage death rate in 2022 increased nearly 22%.

AAA study – 95% of motorist responded positively to DMS/VMS and VSL displays

Source: National Safety Council, March 2023

IntelliRoad

Redefining Connected…

A planning concept that combines transportation and consumer technology.

- Consumer Tech: Automobile, e-bike, e-scooter, wearables, smart phones, etc.
- As agencies include consumer tech to the traditional transportation tech planning, they are redefining connected.
- As a result more data becomes available to continually improve safety and mobility services.

Partnership with Florida's Turnpike Enterprise (FTE)

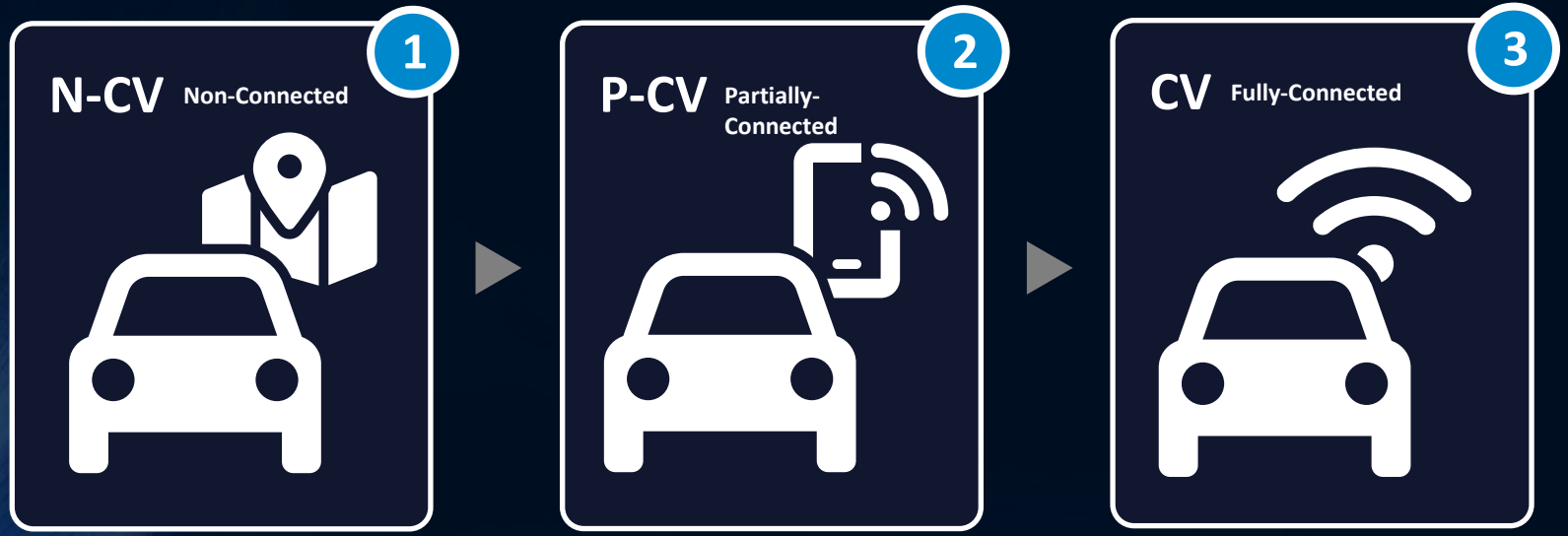
A Commitment to Safety

FTE's V2X – CV Safety Program (Initiate & Sustain)

- Service Equity – Safety for All
- Meaningful and Time Sensitive Safety Messaging – Audio First
- Use of technology to identify Unsafe Roadway Conditions

CV Message Delivery Options for A Sustainable Data-Enabled Con-Ops

FTE's V2X – CV Safety Program • "Safety for All" • 1 Solution with 3 Message Delivery Options – Audio First



CV Message Delivery Options for A Sustainable Data-Enabled Con-Ops

FTE's V2X – CV Safety Program • "Safety for All" • 1 Solution with 3 Message Delivery Options – Audio First

1 N-CV Non-Connected

- In-car displays, mobile smart phones
- Static and dynamic geofencing technology
- Technology-agnostic solution

2 P-CV Partially-Connected

- Smart phone as an OBU
- Heading, location, and speed parameters mobile device
- RSUs plus optional edge computing
- Technology-agnostic solution

3 CV Fully-Connected

- Connected Vehicle's (OEM's) on-board units (OBUs)
- Roadside units (RSUs) plus edge computing
- Technology-agnostic solution

CV Message Delivery Options for A Sustainable Data-Enabled Con-Ops

FTE's V2X – CV Safety Program • "Safety for All" • 1 Solution with 3 Message Delivery Options – Audio First

1 — N-CV Non-Connected

SPaT message/Mission Critical Safety Message

2 — P-CV Partially-Connected

Hot-Spot/Work-zone/EEBL Warning

3 — CV Fully-Connected

Wrong-Way Driving Detection

CV

FULLY-CONNECTED VEHICLES

Use Case:
Wrong-way Driving

The Request…

A technology-agnostic software solution for safety and compliance, providing messaging and information services for traffic management and motorists

IntelliConnect

- Messaging Equity for all motorists N-CV, P-CV, and CV
- Compliance for congestion pricing (real-time communication of pricing changes)
- Device health monitoring (RSU's, Sensors, Cameras, Signs …etc.)
- Data collection, fusion, and correlation for new use case discovery
- Integration with the existing agency app, 511, Waze, and fleet providers
- Public Service and Safety Messaging for Motorists and Traffic Management professionals

SAFETY for ALL

A CALL TO ACTION

As you can see from the work done at FTE, we all have an opportunity to *bridge the GAP to CV, NOW!*

Thank You

IntelliRoad

To learn more about IntelliConnect Solutions check out our website or email me directly.

A DIVISION OF KYRA Solutions • https://intelliroad.io

AD Desai
Vice President - ITS
AD@intelliroad.io

Michael Hunter

Professor

Georgia Institute of Technology

A Few Thoughts on Human Driver & AV Interaction

STRIDE

Southeastern Transportation Research, Innovation, Development and Education Center

Michael Hunter

9/8/2023

https://clipart-library.com/data_images/190035.png

The two most common assumptions to model AV driving behaviors are cooperative responses to other road users and conservative driving behavior. Generally human driven vehicles are assumed to be cooperative or treat AV as a human driven vehicle.

Yes – No – Maybe?

Human - AV Merging

https://clipart-library.com/happy-kids-clipart.html

https://clipart-library.com/clipart/dT9pp56ac.htm

How aggressive would you be?

Photo credit: Chris Toth

Initial Efforts – Off-Ramp

AV

- Autonomous Vehicle
- Cooperative driving behavior

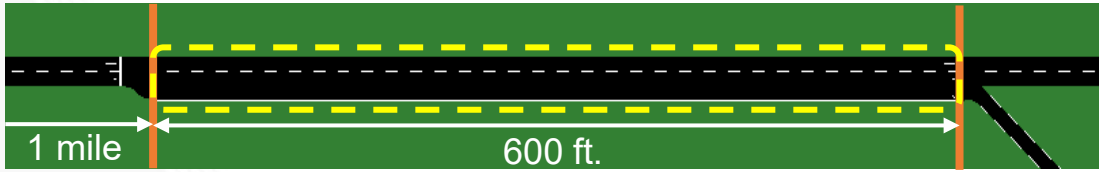
HDV

- Human-Driven Vehicle
- Same cooperative driving behaviors as AV
- Are not targeted by AHDV

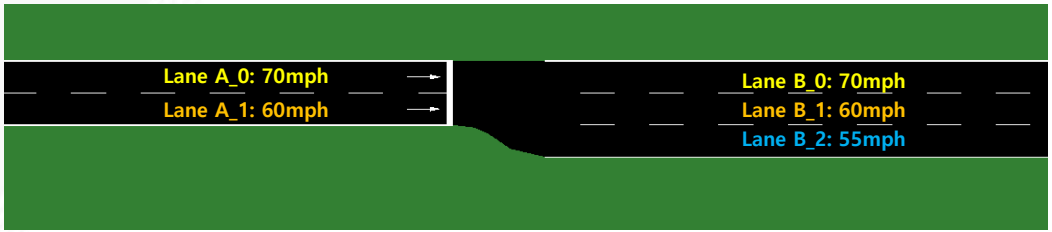
AHDV

- Aggressive Human-Driven Vehicle
- Higher desired speed lane
- Aggressive behaviors towards AV
- When AV is unavailable, non-aggressive merge performed

Initial Efforts – Off-Ramp

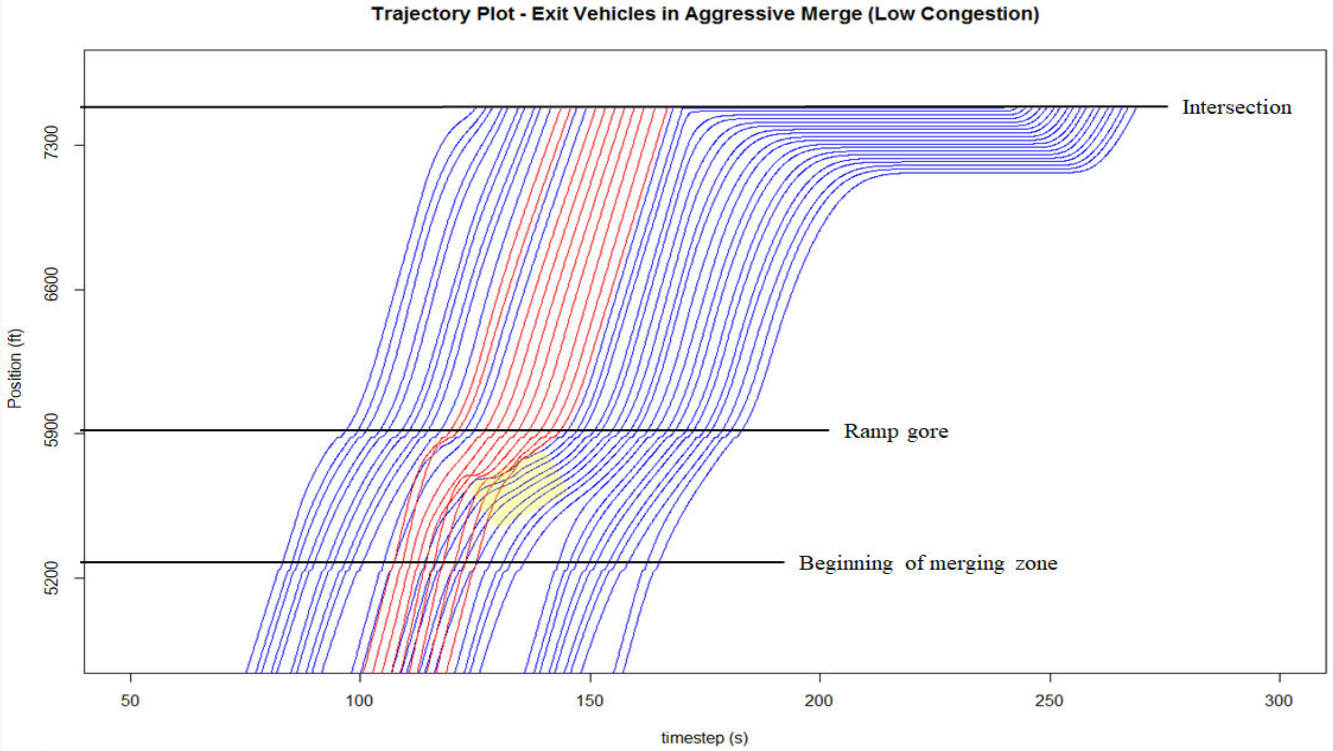


Merging Zone Layout – Highlighted in yellow



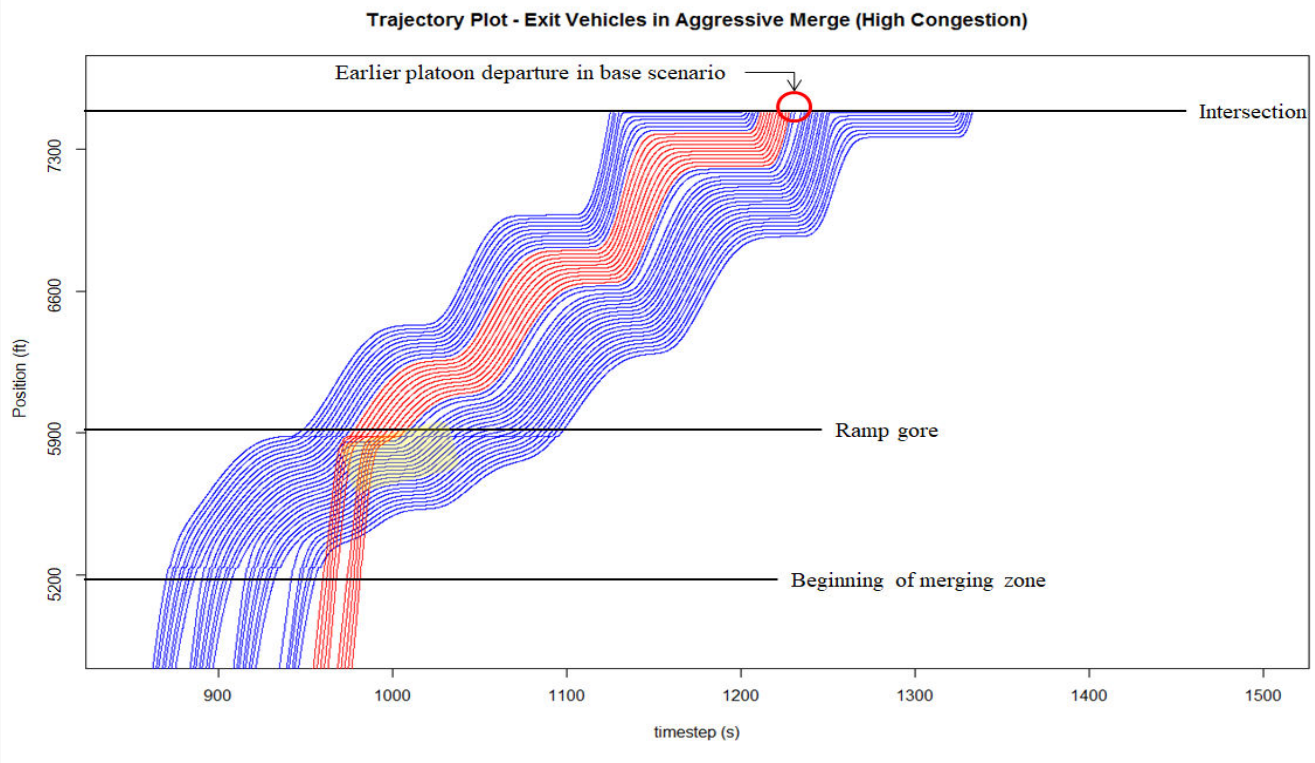
Lane Speed

Initial Efforts – Time-space Diagrams



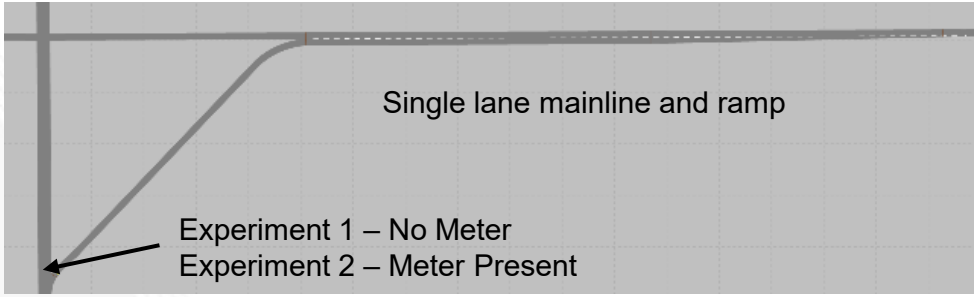
Red – AHDVs, Blue – Traffic on Deceleration Lane

Initial Efforts – Time-space Diagrams (Max.)

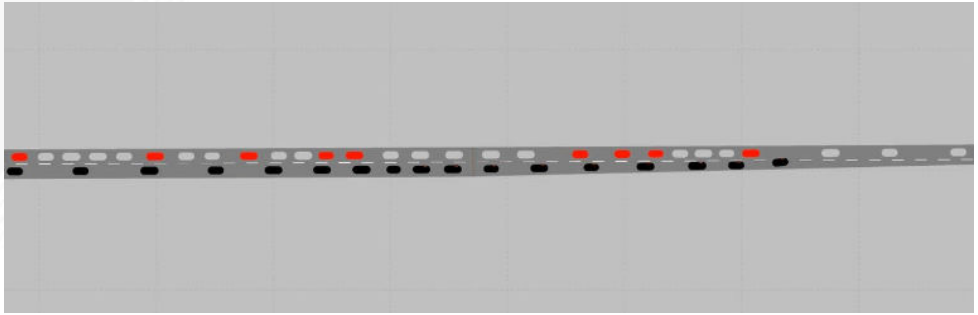


Red – AHDVs, Blue – Traffic on Deceleration Lane

On-ramp Scenario – Capacity Impacts



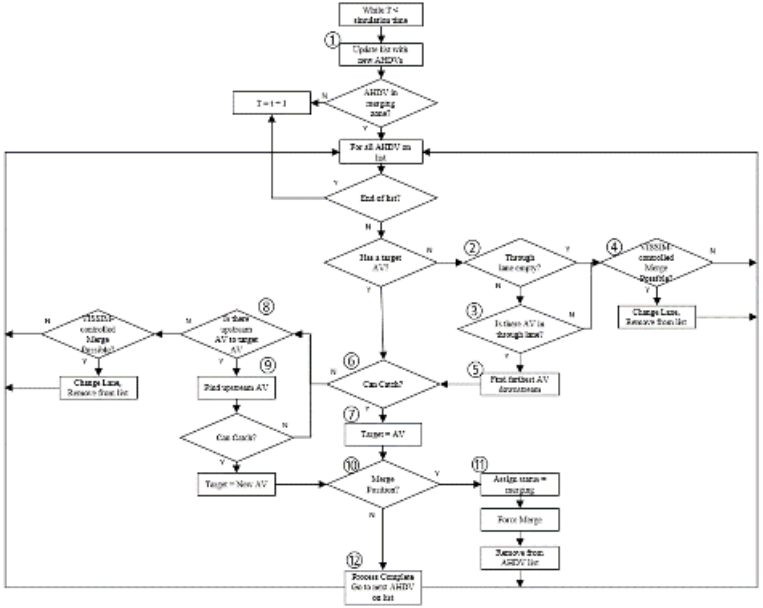
(a)



(b)

On-ramp Test-Bed: (a) Network and (b) Fully loaded demand

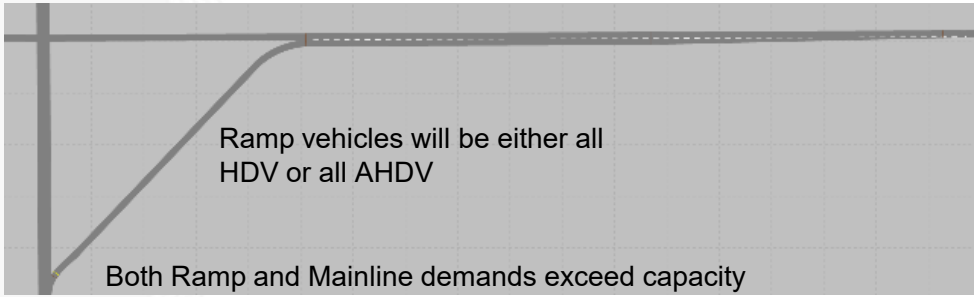
Aggressive Vehicle Merging Behavior



AHDV will seek to maximize advancement. Merge in front of furthest downstream AV without concern for available gap.

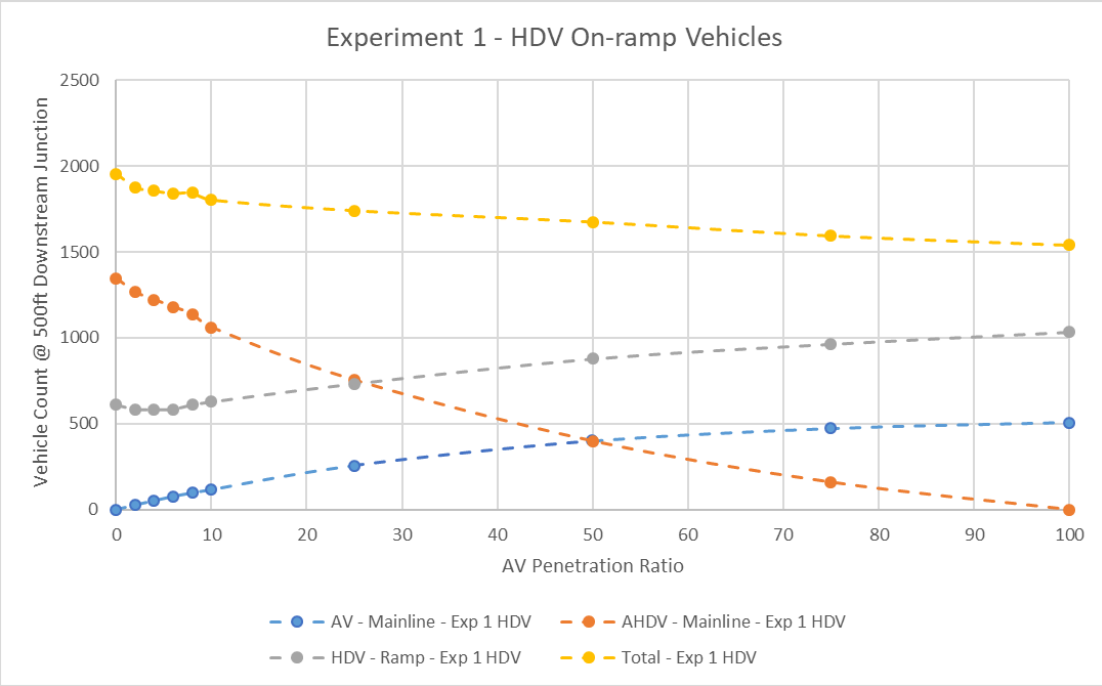
Experiment

Mainline vehicles will be a mix of AHDV and AV.

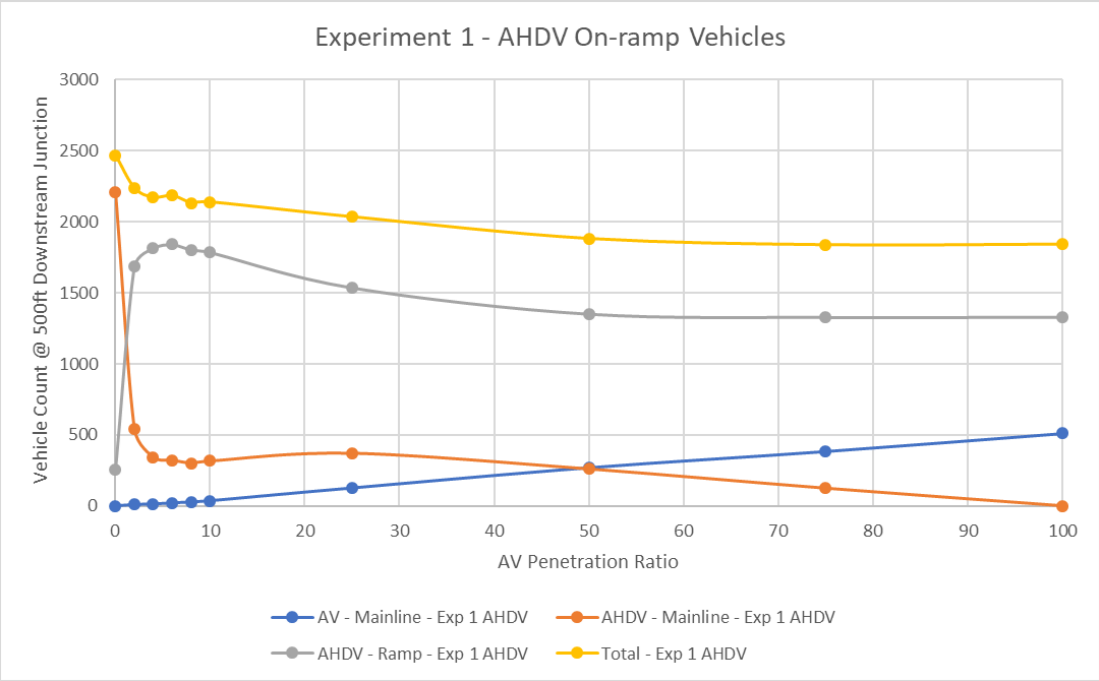


Volume data collected 500 ft downstream end of merge

Sample Results



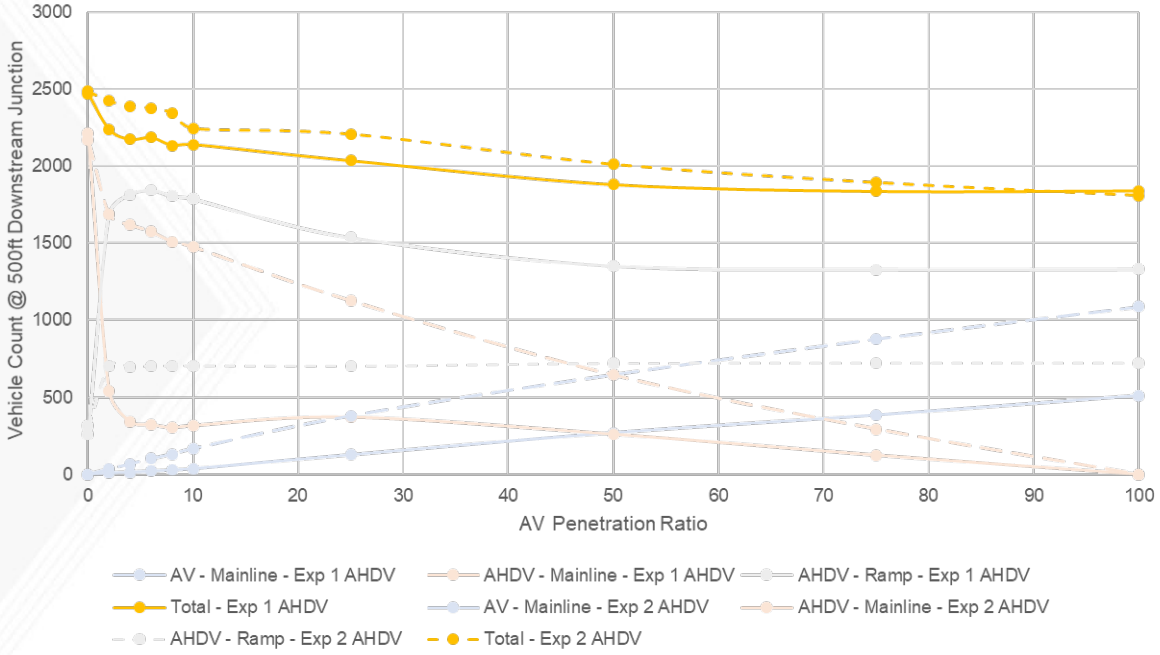
Sample Results



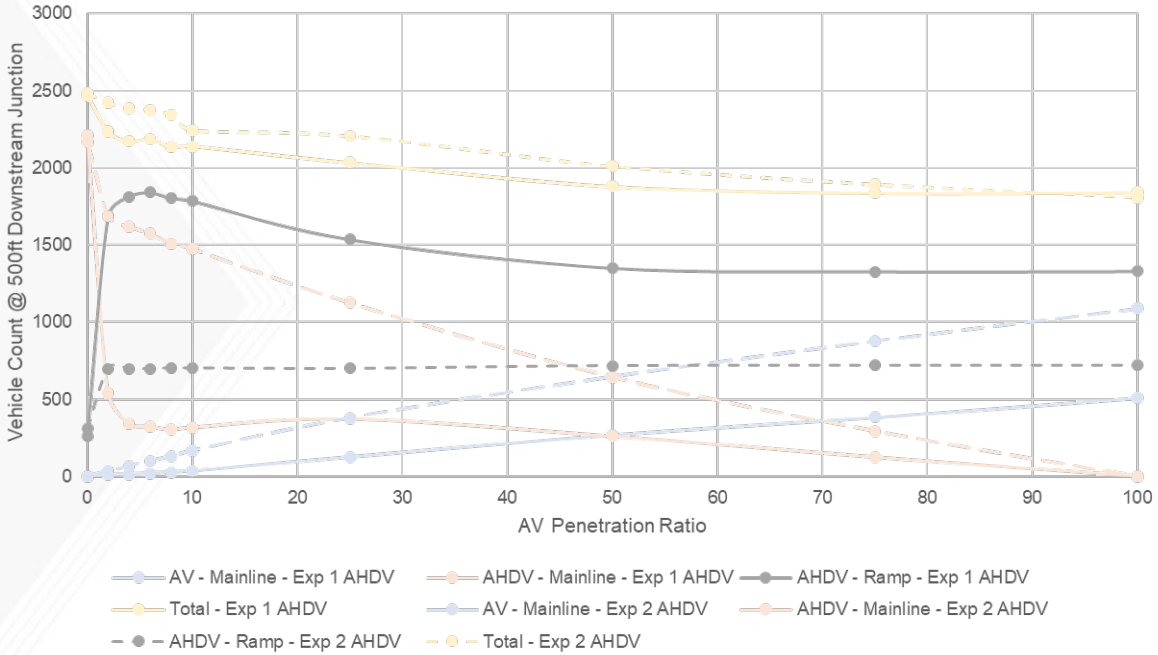
Sample Results
Number Vehicles that Merge in from of AV

	On-Ramp (veh/hr)	
AV Ratio (%)	AHDV	HDV
0	NA	NA
2	153.63	21.12
4	128.36	11.06
6	84.22	7.42
8	62.61	6.22
10	48	5.32
25	12.13	2.86
50	5.01	2.19
75	3.46	2.04
100	2.61	2.04

Sample Results with Ramp Meter



Sample Results with Ramp Meter



Thoughts

- Study of future impacts of AVs should include consideration of potential changes in human driver behaviors
- Drivers may take advantage of AVs
- Aggressive driving has potential to significantly impact traffic flow, capacities, and travel times
- Impacts will not be experienced equally across vehicle types or locations
- May need to consider mitigations to balance impacts
- Modeling “outside-the-box” may require use of additional analytic tools
- Transportation System and Operations Managers roles will change

Please feel free to reach out to me with any comment or questions at:

Michael.Hunter@ce.gatech.edu

https://clipart-library.com/images/6ip6R5GAT.jpg

Sgt. Robert Dooley

Unmanned Aerial Systems Coordinator

Florida Highway Patrol

UNMANNED TECHNOLOGY FOR PUBLIC SAFETY

FLORIDA HIGHWAY PATROL

FLORIDA AUTOMATED VEHICLES

SERGEANT ROBERT DOOLEY
ROBERTDOOLEY@FLHSMV.GOV

FHP Statewide UAV Coordinator

Law Enforcement Lead for the Florida Group

Aviation Committee

National FAA Representative

Director of Public Safety

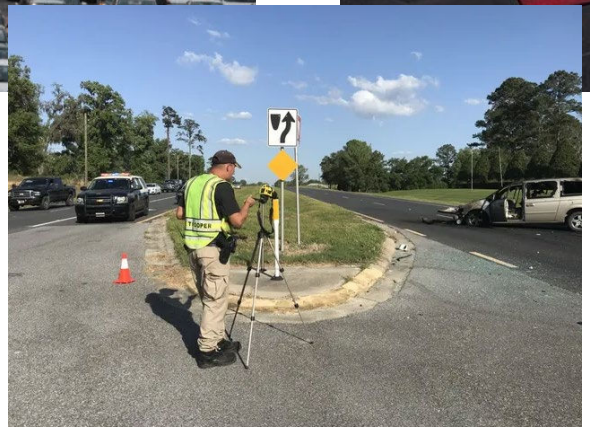
IMPACT OF CLOSED ROADS AND CONGESTION ACROSS THE U.S.A.

INRIX

Texas A&M Transportation Institute | Mobility Division

U.S. Department of Transportation

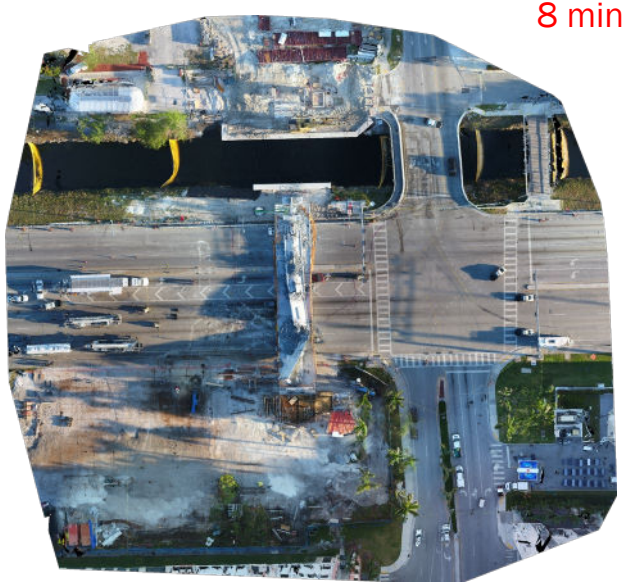
TRAFFIC CRASHES AND FATALITIES



WORKING TOWARDS THE FUTURE

FIU Bridge Collapse

Using Conventional
Measuring Equipment:
Took 7 FHP Traffic Homicide
Investigators 3 whole days
To map with a Total Station

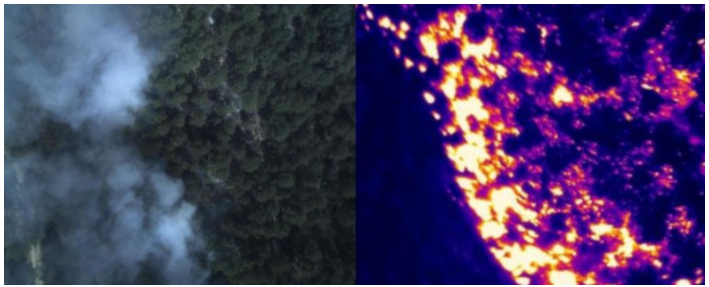


1 Trooper Using
UAV mapping
Technology:

8 minutes 04 seconds

DAMAGE ASSESSMENT TO GET ROADS OPEN SOONER

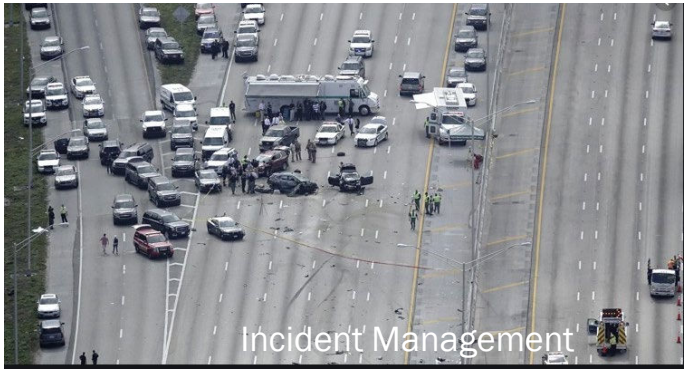
HOW PUBLIC SAFETY IS USING UAV TECHNOLOGY TO SAVE LIVES AND PROTECT OUR COMMUNITIES.



FIRE

HAZMAT

LAW ENFORCEMENT SIDE



USING UNMANNED TECHNOLOGY AS A FIRST RESPONDER

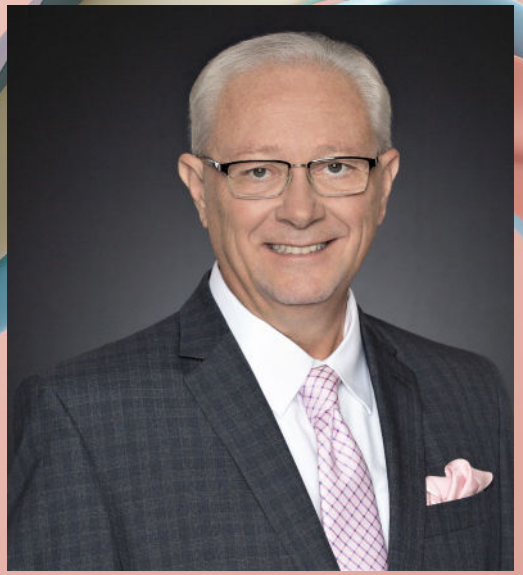
Steven Johnson

Sr. Control Systems Cybersecurity Specialist

HDR

Are we there yet? Our journey to safe and smart mobility.

Automated, Connected, Electric and Shared (ACES) Vehicles
….. And the Expanded Cybersecurity Threat Surface

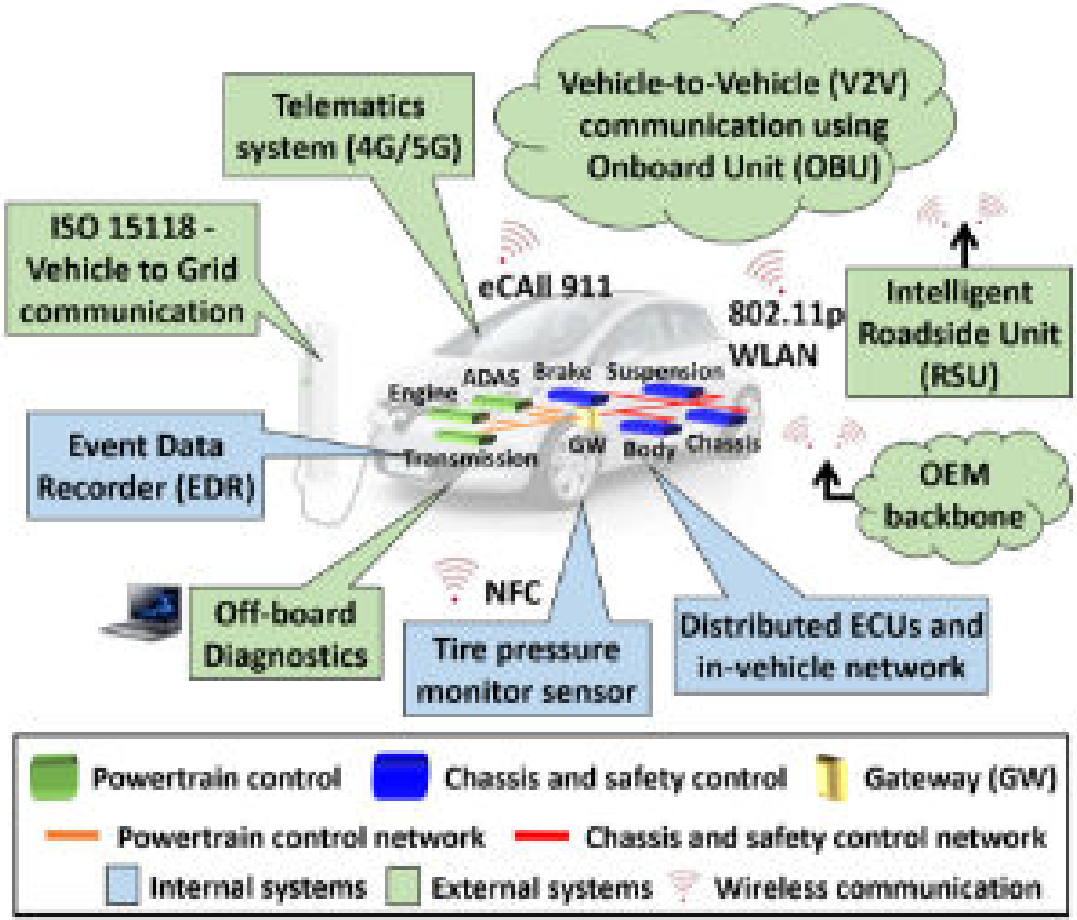


Steve Johnson, MSc, CISSP, CVP

HDR, Sr. Control Systems Cybersecurity Specialist

Florida Automated Vehicle Summit, September 2023

Traditional IT-based Cybersecurity Tools Like Firewalls and Rule-based IDS, Don’t Apply Well to ACES.



V. K. Kukkala, S. V. Thiruloga and S. Pasricha, "Roadmap for Cybersecurity in Autonomous Vehicles," in IEEE Consumer Electronics Magazine, vol. 11, no. 6, pp. 13-23, 1 Nov. 2022, doi: 10.1109/MCE.2022.3154346.

Roadmap for Cybersecurity in Autonomous Vehicles

Vipin Kumar Kukkala, Sooryaa Vignesh Thiruloga, and Sudeep Pasricha
Colorado State University

Summary of AI-based IDS Examined in the CSU Study

System Level	Work	Technique
In-vehicle Network	GIDS	GAN based IDS using CAN images
	INDRA	GRU based recurrent autoencoder; static threshold-based attack detection
	LATTE	LSTM based encoder-decoder with self-attention; OCSVM based attack detection
	TENET	Temporal CNN with neural attention; DT based classifier for attack detection
VANET	RACCON	Explores five different machine learning techniques; static threshold to detect V2V attacks
	DD-IDS	CNNs to detect attacks aimed at RSUs
	CS-IDS	DBN for data reduction; DT classifier to detect attacks in received cloud service requests
	AED-ITS	LSTM based autoencoder; static threshold to detect V2V and V2I attacks

Key Elements in the Cybersecurity Roadmap for AV - CSU Study

Roadmap Elements	Components
Cybersecurity-aware design practices	Security requirements
	Multi-layered security
	Zero trust security
Secure hardware and software stack	HSMs and TPMs
	SDL for automotive software
	SOTA and FOTA updates
New security and AI standards and regulations	ISO/SAE 21434
	UNECE WP. 29
	AI regulations
Advanced threat intelligence	Vulnerability assessment
	Penetration testing
	Auto ISAC
Open challenges	Data protection and privacy
	Tamper-proof AI
	Securing automotive IC supply chain Adopting emerging technologies

V. K. Kukkala, S. V. Thiruloga and S. Pasricha, "Roadmap for Cybersecurity in Autonomous Vehicles," in IEEE Consumer Electronics Magazine, vol. 11, no. 6, pp. 13-23, 1 Nov. 2022, doi: 10.1109/MCE.2022.3154346.

High-Priority Impediments to AV Advancement

- According to USDOT:
  - "Improving access to work zone data is one of the top needs identified through the U.S. DOT's Data for Automated Vehicle Integration (DAVI) initiative."

From the DAVI 4.0 Guiding Principles

1 **Promote proactive, data-driven safety, cybersecurity, and privacy-protection practices.**

2 **Act as a facilitator to inspire and enable voluntary data exchanges.**

3 **Start small to demonstrate value and scale what works toward a bigger vision.**

4 **Coordinate across modes to reduce costs, reduce industry burden, and accelerate action.**

Florida is a Leader in Preparing for AV Proliferation

FDOT's V2X Data Exchange Platform

- Data Generators
  - **Collects V2X Data from multiple generators and stores it in a data lake for both real-time applications and research.**
  - **Generators/Collectors include FDOT District CV architecture, Ford Motor Company, and 3rd Party service providers.**
  - **WZDx streams include real-time work zone info from smart work zone implementations and ties to the GIS permitting system**

- Data Consumers
  - **ADAS Systems – via service providers**
  - **Mapping and Traveler Information Services**
    - **Here, WAZE, Google, Bing, etc**

Info for ADAS Guidance and;

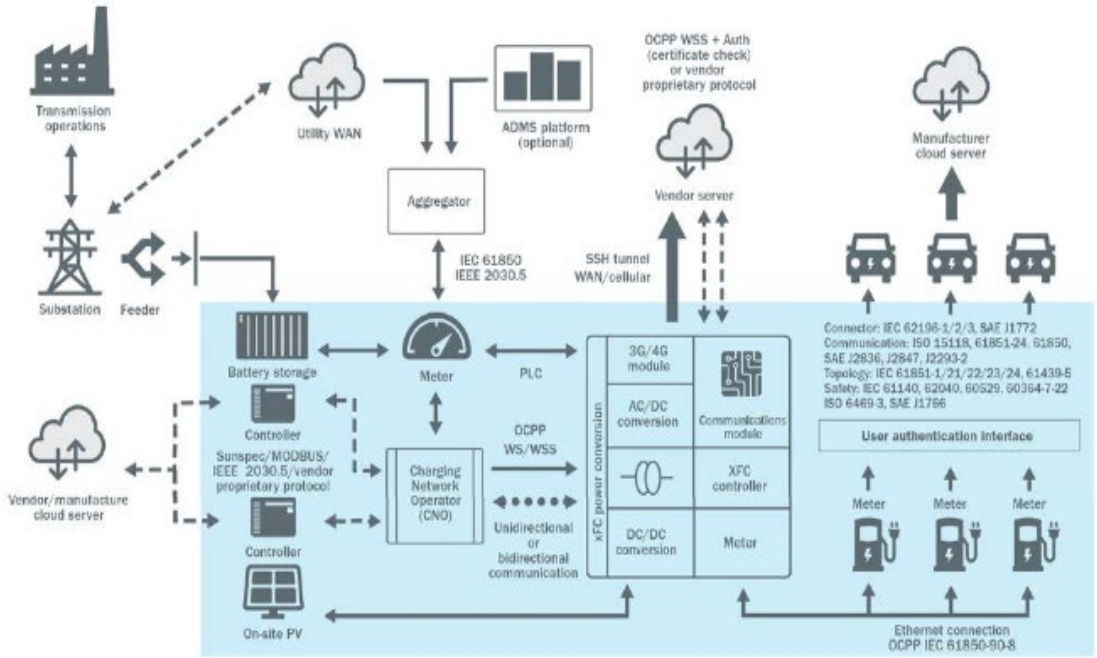
=

Potential Privacy Data

Strong Need for

Cybersecurity

Cybersecurity for Electric Vehicles, A Complex Threat Surface



End-to-End Considerations

- Vehicle to EVSE Threats
  - Theft of Service
  - Disruption of Service
  - Damage to Equipment
- EVSE to vehicle Threats
  - Breach of PII
  - Breach of Financial Data
  - Damage to Vehicle
- Threats to the Power Grid
  - Extreme Fast Charging (XFC) necessitates connection from the EVSE to the power grid
  - 2-Way Connection to the power grid opens vulnerability for the grid
  - Open and equal access requirements provide a huge point of access for sophisticated actors to weaponize a vehicle to disrupt or damage the power grid.

Sanghvi, Anuj and Tony Markel. 2021. Cybersecurity for Electric Vehicle Fast-Charging Infrastructure:
Preprint. Golden, CO: National Renewable Energy Laboratory.
NREL/CP-5R00-75236. https://www.nrel.gov/docs/fy21osti/75236.pdf.

Closing (Random) Thoughts

Uncertainty (Immature Standards) Inhibits Investment $$$ ……
as witnessed by the FCC DSRC Impact on CV Advancement

WORKFORCE DEVELOPMENT / SHORTAGES ARE IMPACTING AVAILABILITY OF CERTIFIED CYBERSECURITY STAFF

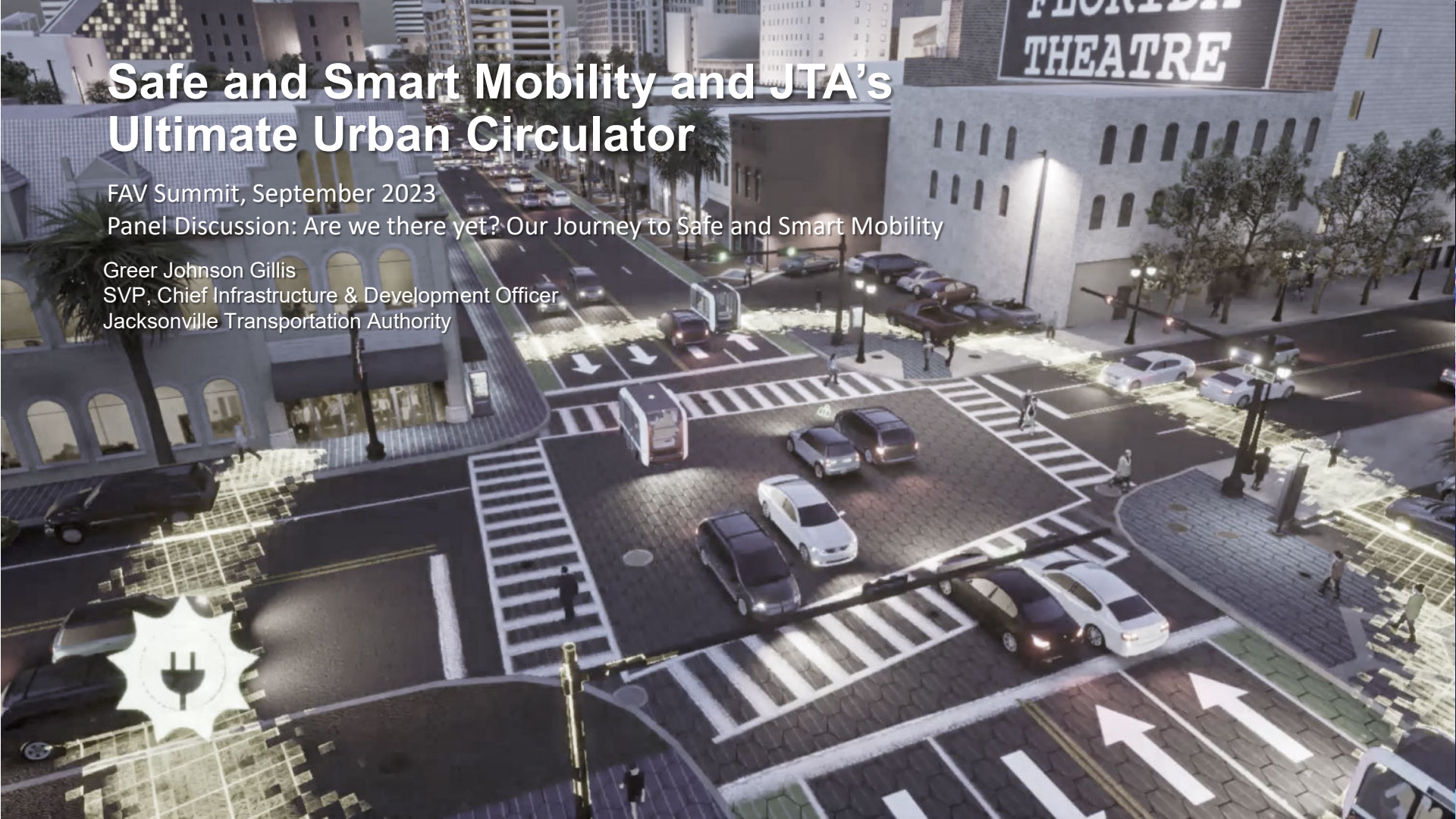
NEVI Program Required States to Include a Cybersecurity Section in Their Application for Grant Funding….. But the Final Rule Doesn't Give The States Any Specifics on a Cyber Plan Requirement for Sub-recipients and no Teeth to Require Any Standards

AV Technology and Applications Don't Scale as Well as Most, So Individual Use Cases may "Not Fit the Mold" in Terms of Technology or Cybersecurity.

Greer Johnson Gillis

Senior Vice President – Chief Infrastructure and Development Officer

Jacksonville Transportation Authority



Safe and Smart Mobility and JTA's Ultimate Urban Circulator

FAV Summit, September 2023

Panel Discussion: Are we there yet? Our Journey to Safe and Smart Mobility

Greer Johnson Gillis
SVP, Chief Infrastructure & Development Officer
Jacksonville Transportation Authority

Bay Street Innovation Corridor Vision2Reality Team

Balfour Beatty

Stantec

SUPERIOR CONSTRUCTION

January 2022
Phase I Start

August 2022
Phase IA 30% Design

March 2023
Phase IB 60% Design

June 2023
Phase II Start

June 2025
Phase II Finish

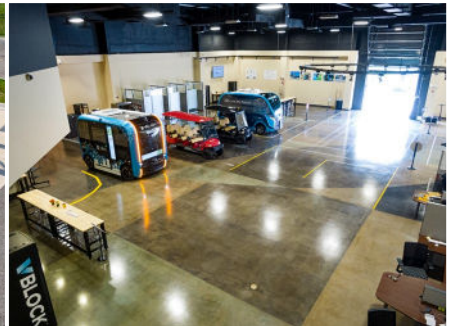
Early 2025
Phase III – AV Operations


UF HEALTH & VA
8TH & MAIN
NORTH CORRIDOR
95
2ND & MAIN
ROSA PARKS
DOWNTOWN
WEST CORRIDOR
JRTC
JEFFERSON
HEMMING PARK
BROOKLYN
CENTRAL
MARKET ST
EAST CORRIDOR
SHIPYARDS
SPORTS COMPLEX
RIVERSIDE
RIVERPLACE
RAM
SAN MARCO
KINGS AVE
THE DISTRICT
FIVE POINTS
SOUTHWEST CORRIDOR
MEDICAL COMPLEX
SOUTHBANK / SAN MARCO CORRIDOR
EAST SAN MARCO
95


MOUS VEHICLE
ARN


ARMSDALE PARK-N-RIDE
Test & Learn Facility
U2C
3101


ZERO EMISSION FULLY AUTONOMOUS




Innovation


CES
Panasonic
WELCOME TO
LAS VEGAS
Panasonic


WELCOME
Summer 2022 Interns


RIVER CITY SCIENCE ACADEMY
INNOVATION K-8

BAY STREET INNOVATION CORRIDOR (BSIC) ULTIMATE URBAN CIRCULATOR (U^2C)

STATIONS

BASED ON PRELIMINARY DESIGN SUBJECT TO CHANGE

Regulatory & Local Issues


Thank You!

HDR