

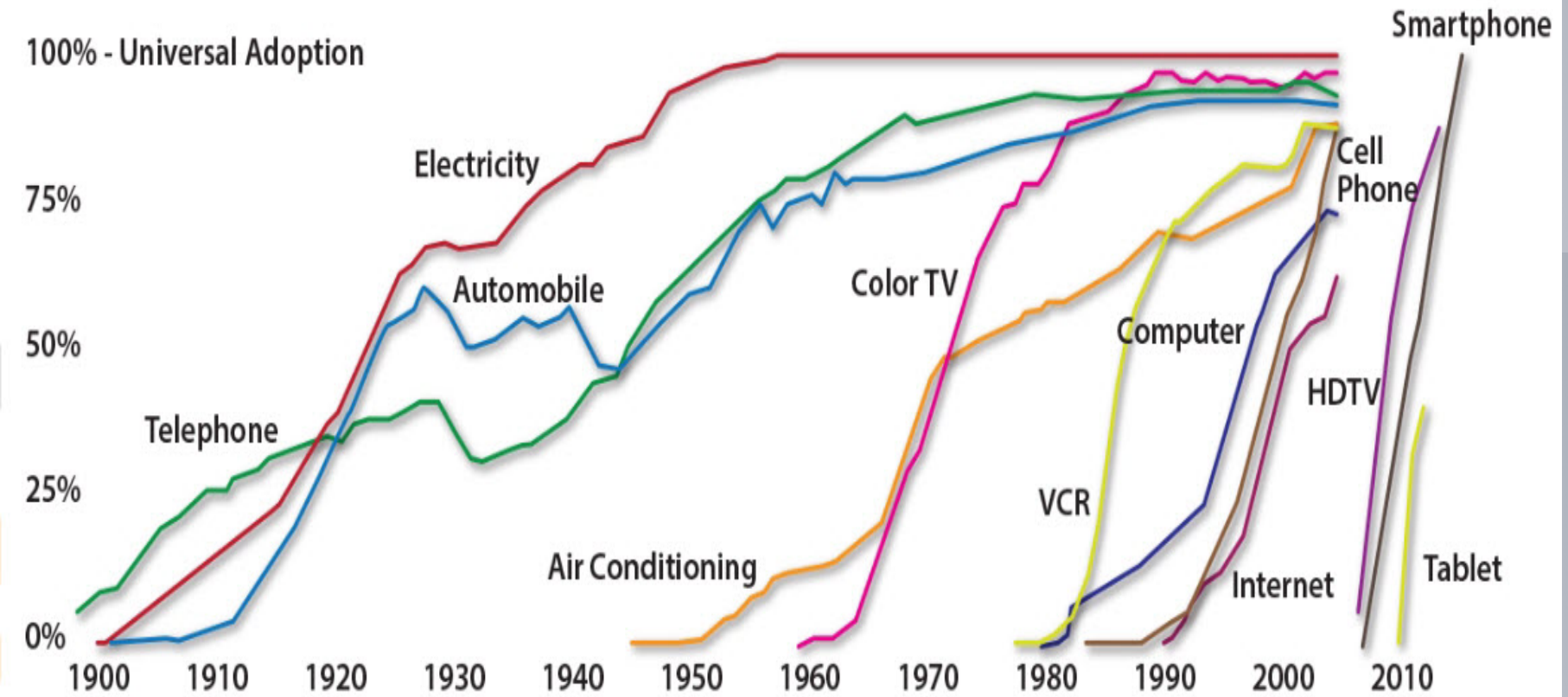
HDR

Florida Automated Vehicles (FAV) Summit:
Improving Mobility Across Multiple Modes

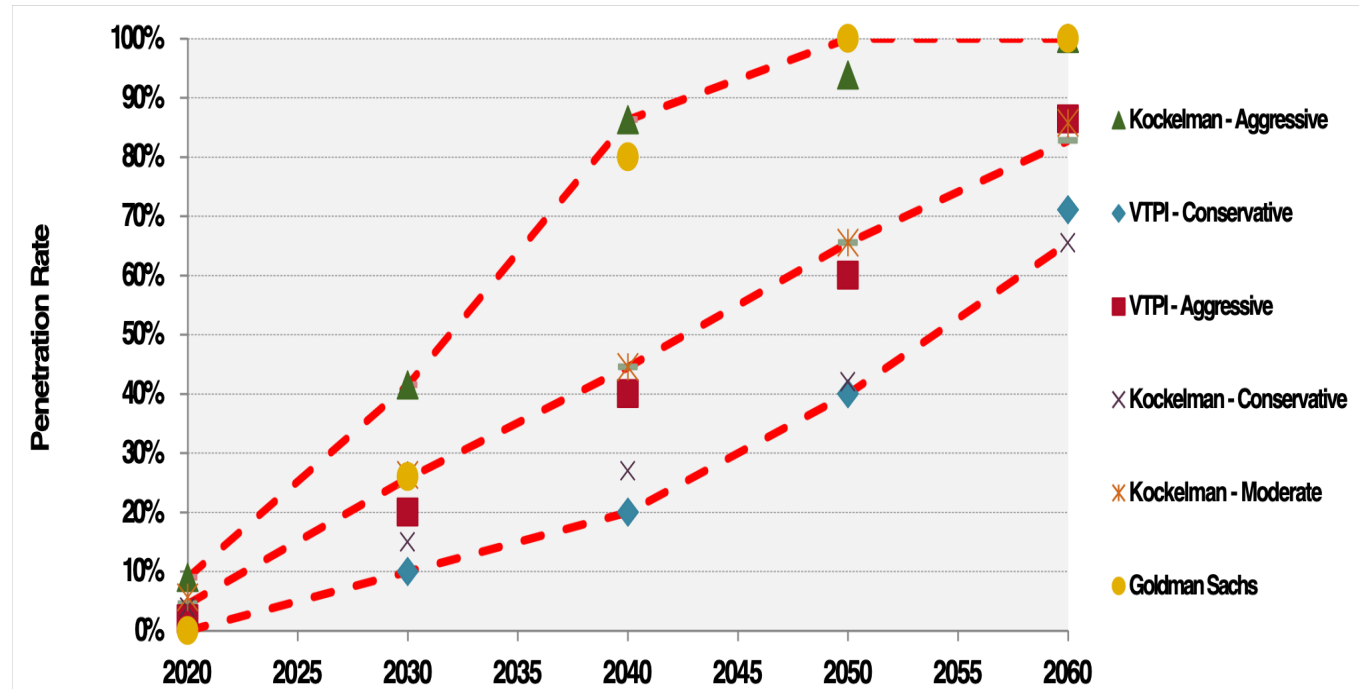
11/28/18
Chris Pauly



Speed of Adoption for Major Technology Innovations



Estimated Autonomous and Connected Vehicle Adoption Rates



	2020	2030	2040	2050	2060
Autonomous	0-10%	10-40%	20-85%	40-100%	65-100%
Connected	0-10%	40-60%	80-100%	~100%	~100%

Connected Vehicle & Autonomous Vehicle adoption rates will differ based on rate of technology innovation and regulatory environment.

2020

Set the Stage for CV Technology Adoption



2030

Set the Stage for AV Technology Adoption



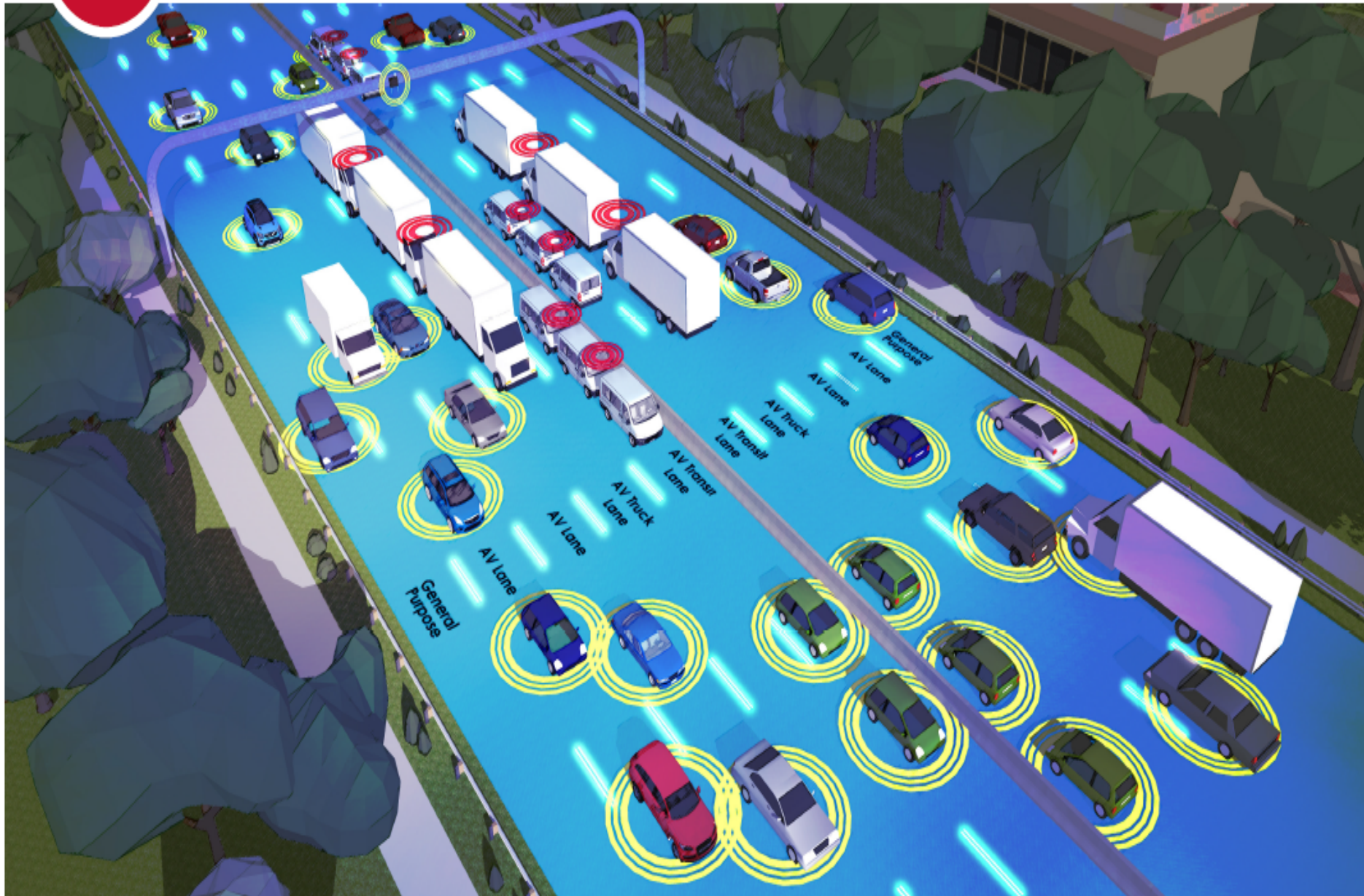
2040

Embrace a Fully Connected Transportation Network while Increasing AV Facilities

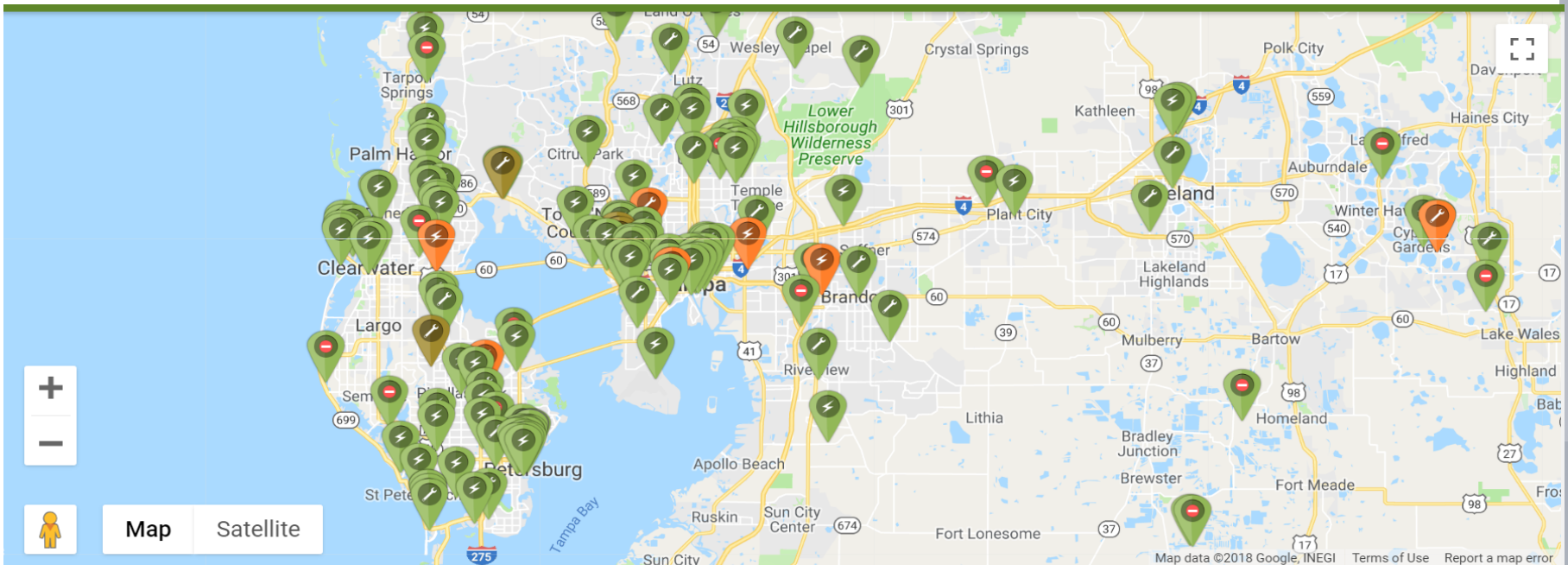


2050

Set the Stage for AV Technology Adoption



Electrification: What's Need to Achieve a CAV Reality



22K Public Level 2 or DC Fast Chargers in the US/Canada, as of July 2018

The US Department of Energy estimates there will need to be **330,000** chargers by 2025 to support electric vehicles which is a total investment of \$4.7 Billion.

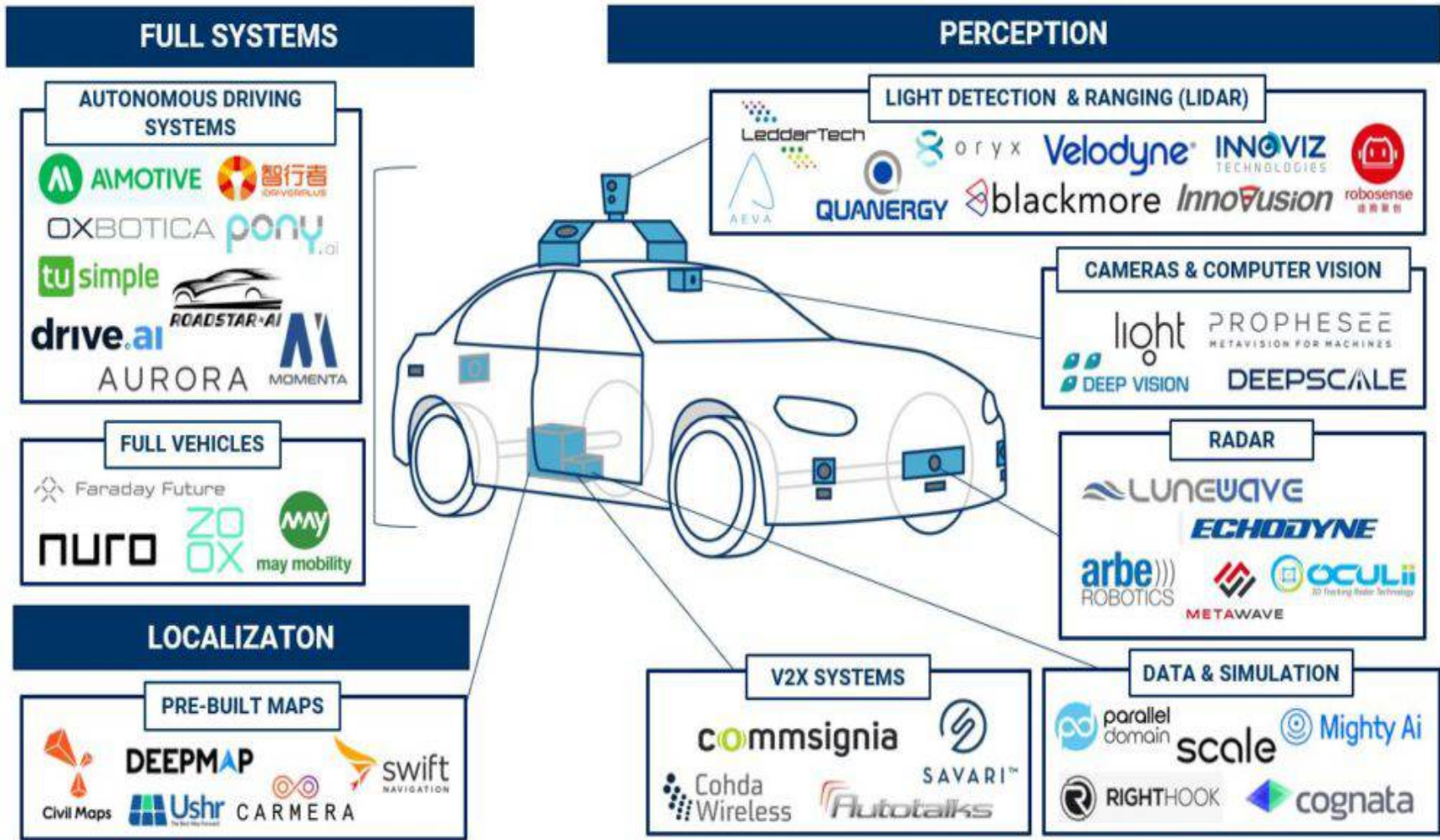
Wireless charging and wireless roadways will become an increasingly interesting option for charging as costs fall.

The Autonomous Vehicle Space ...

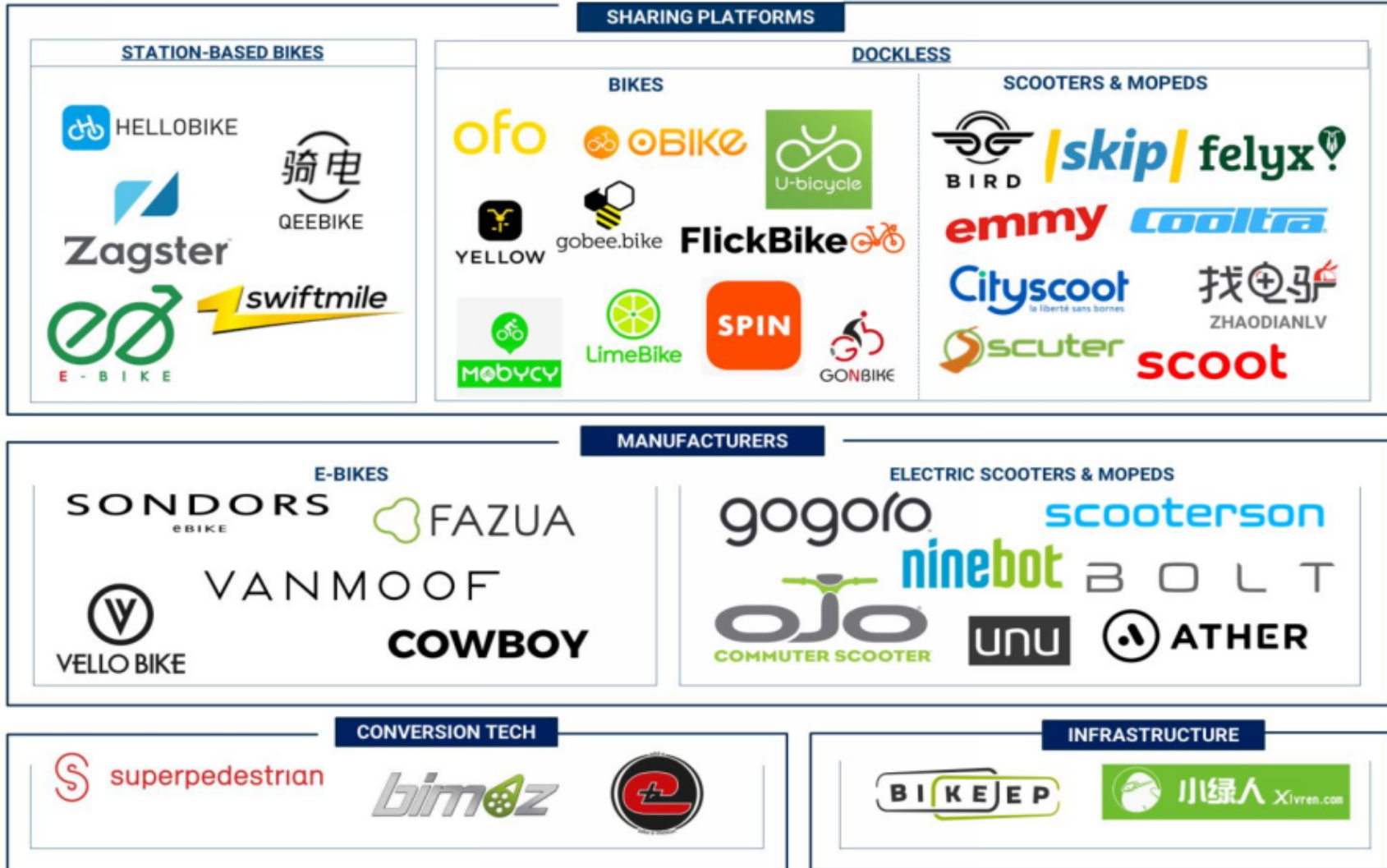


Huge, Complicated & Growing!

Unbundling the Autonomous Vehicle ... A Closer Look.



Bike and Scooter Tech ... A Bit Player in Micro Mobility



Critical Enabling Technologies Allows CAV to Operate ... Today

Connected and Autonomous Vehicles

- V2V, V2I, V2X
- Operator “free” travel – eliminates or greatly reduces role of driver
- Safety improvements
- Reduced operational costs

Enabling Technologies

- Connected Vehicle Dedicated Short Range Communications
- 4G/5G Cellular/Wireless
- LiDAR, Radar, Vision-based cameras
- Ultrasonic sensors, GPS



Emerging Technologies will Allow CAV to Flourish ... Tomorrow

Transit Specific Technologies

- Retrofit pedestrian and vehicle detection and warning systems
- Fully autonomous transit vehicles
- Alternative fuel technology

Enabling Technologies

- Connected Vehicle Dedicated Short Range Communications
- Vision-Based cameras/sensors
- Battery technology
- Inductive charging systems



Future Technology Integration will Allow CAV to Truly Connect

Truly Connected Travelers

- Communicates directly with vehicles in **real-time**
- Travel information is **readily accessible**
- Enables **dynamic** trip requests/routing
- Pedestrian **warning systems**
- **Enhanced** fare payments

Enabling Technologies

- Connected Vehicle Dedicated Short Range Communications
- 4G/5G Cellular/Wireless
- Dual-Chip fare cards/transit fare collection
- Mobile Phone payment systems



CAV First & Last Mile Use Cases for Today & Tomorrow



City Centers



Airports



Retirement Homes



Hospitals



Train Stations



Industrial Sites



Theme Parks/
Cultural Sites



Campus



Just a brief CAV Snapshot ... But There Lessons Learned Based on Current CAV Deployments



Lessons Learned: Current CAV Deployments

About HDR

HDR is a nationally recognized architectural, engineering, design, planning and consulting services firm with nearly 10,000 employee-owners providing services to public and private clients throughout the United States, including much experience in California and around the Los Angeles area region.

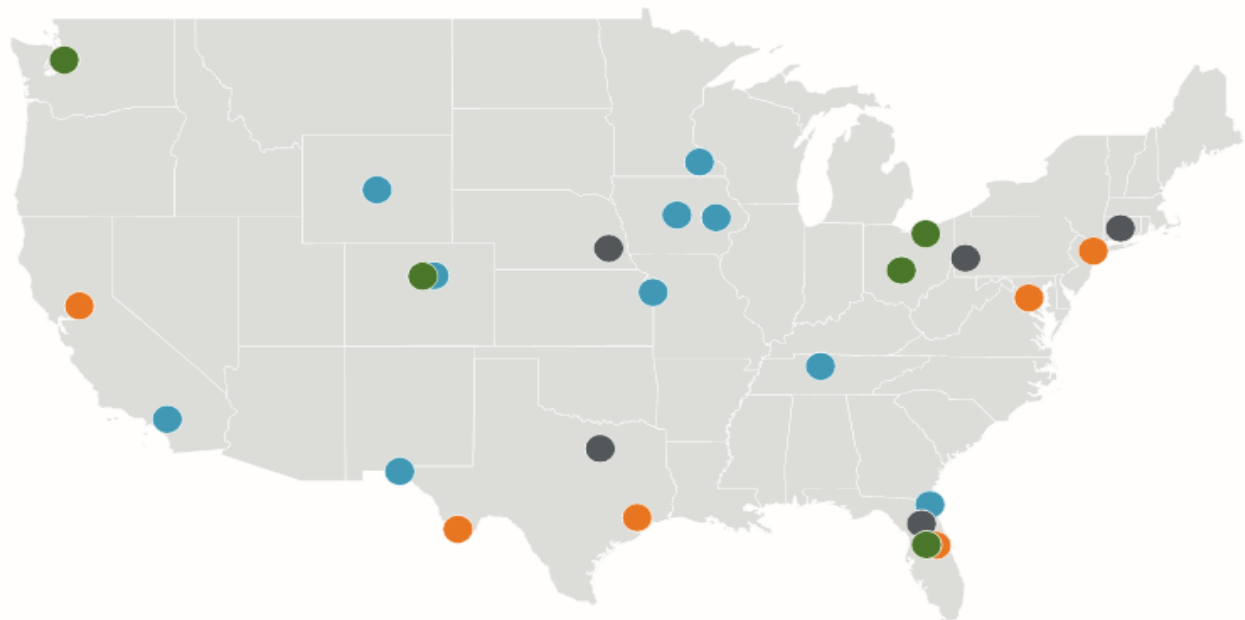
HDR is an industry leader in advanced transportation and technology implementations including comprehensive expertise in the piloting and implementing of AV microshuttles and other CAV technologies.

HDR's Advanced Technology Project Experience in Last Two Years

HDR's CAV and emerging transportation technology expertise includes the delivery of 25 technology oriented plans, policies, guidance, environmental, and design projects across the United States as shown in the Figure below.

LEGEND

- AV Micro-Shuttle
- AV Systems/Corridors
- CAV Strategic Plans
- CAV Evaluation Tools



NHTSA: Permitting Low Speed Micro Shuttles

All vehicles that operate on public roads must meet Federal Motor Vehicle Safety Standards (FMVSS).

Vehicles not imported and that do not meet FMVSS are not permitted to operate on public roads without a waiver which can be granted under prescribed conditions.

Vehicles imported into the United States can receive a waiver to the relevant FMVSS and legally be allowed to operate on public roads.

The waiver allows for vehicles to be temporarily imported for research or demonstration purposes only.

An importer of a non-compliant vehicle must receive a permission letter from NHTSA prior to importation.

Guidelines to receiving a letter are found at:

www.nhtsa.gov/cars/rules/import

— DECLARATION —			
Importation of Motor Vehicles and Motor Vehicle Equipment Subject to Federal Motor Vehicle Safety, Bumper and Theft Prevention Standards			OMB No. 2127-0002 Public Law 100-662, 49 USC Chap. 301
PORT OF ENTRY	CUSTOMS PORT CODE	CUSTOMS ENTRY NO.	ENTRY DATE
MAKE OF VEHICLE	MODEL	YEAR	VEHICLE IDENTIFICATION NUMBER (VIN)
REGISTERED IMPORTER NAME AND NHTSA REGISTRATION NUMBER (Required when Box 3 is checked)			VEHICLE ELIGIBILITY NO. (Box 3)
DESCRIPTION OF MERCHANDISE IF MOTOR VEHICLE EQUIPMENT			

- D1. The vehicle is 20 or more years old or the equipment item was manufactured on a date when no applicable Federal Motor Vehicle Safety Standard or Theft Prevention Standard was in effect.
- D2. The vehicle or equipment item conforms to all applicable Federal Motor Vehicle Safety Standards for the vehicle does not conform solely because readily attachable equipment items that will be attached to before it is offered for sale to the final purchaser for purposes other than resale and not attached, and Bumper and Theft Prevention Standards, and bears a certification label or tag to that effect permanently affixed by the original manufacturer to the vehicle or attached to the manufacturer to the equipment item or to its delivery container in accordance with applicable Federal Highway Traffic Safety Administration (FHVTA) regulations (39 CFR 561).
- D3. The vehicle was certified by its original manufacturer as conforming to all applicable Canadian motor vehicle safety standards and its original manufacturer certifies that the vehicle conforms to all applicable U.S. Federal Motor Vehicle Safety, Bumper, and Theft Prevention Standards for that it conforms to all such standards within 100 days after importation into the United States, and the vehicle is not a salvage motor vehicle or 125, and/or the specifications of Standard No. 108 relating to daytime running lamps, and the vehicle is not a salvage motor vehicle, a repaired salvage motor vehicle, or a reconstructed motor vehicle, and I am importing it for personal use. (39 CFR 562).
- D4. The vehicle does not conform to all applicable Federal Motor Vehicle Safety and Bumper Standards, but does conform to applicable Federal Theft Prevention Standards, and I am eligible to import it because NHTSA has determined that the make and model year of the vehicle to be imported is eligible for importation into the United States, and the vehicle is not a salvage motor vehicle or a reconstructed motor vehicle, and I have furnished a bond, which is attached to this declaration, in an amount equal to 150 percent of the estimated value of the vehicle as determined by the Secretary of the Treasury. If the Administrator of NHTSA determines that the vehicle has not been brought into conformity with all such standards within 120 days after importation, then I state that I will deliver such vehicle to the Secretary of Homeland Security for export, or abandon it in the United States (39 CFR 563).
- D5. I have registered with NHTSA pursuant to 49 CFR Part 562 and such registration is not suspended and has not been revoked, or I have executed a contract or other agreement, which is attached to this declaration, with an importer who has registered with NHTSA and whose registration is not suspended and has not been revoked. (39 CFR 564).
- D6. The vehicle or equipment item does not conform to all applicable Federal Motor Vehicle Safety, Bumper and Theft Prevention Standards, but is imported solely for export and is labeled for export on the vehicle or equipment item, and the outside of any container of the vehicle or equipment item bears a label or tag to that effect. (39 CFR 565).
- D7. The vehicle or equipment does not conform to all applicable Federal Motor Vehicle Safety, Bumper and Theft Prevention Standards, but I am eligible to import because of the following conditions exist:
- a. I am temporarily importing the vehicle for personal use for a period not to exceed 1 year, and will not sell it during that time, and
 - b. I will export it not later than the end of 1 year after entry, and the declaration contains my passport number and country of issue. (39 CFR 566)
- D8. The vehicle does not conform to all applicable Federal Motor Vehicle Safety, Bumper, and Theft Prevention Standards, but I am eligible to import because all of the following conditions exist:
- a. I am a member of a foreign government on assignment in the United States, or a member of the Secretariat of a public international organization so designated under the International Organizations Immunities Act, and while the area of performance for which my entry of motor vehicles has been authorized by the Department of State,
 - b. I am importing the vehicle on a temporary basis for my personal use, and will register it through the Office of Foreign Missions of the Department of State,
 - c. I will not sell the vehicle to any person in the United States, other than a person eligible to import a vehicle under this paragraph,
 - d. I will obtain from the Office of Foreign Missions of the State Department, before departing the United States of the country of origin, a temporary title to the vehicle good for export only, and,
 - e. I have attached a copy of my official orders. (39 CFR 567)
- D9. The vehicle or equipment item requires further manufacturing operations to perform its intended function, other than the addition of readily attachable equipment items such as mirrors, spares, or tie and rim assemblies, or minor finishing operations such as painting, and any part of such vehicle that is required to be replaced by the Theft Prevention Standard is marked in accordance with that standard. (39 CFR 568).
- D10. The vehicle does not conform to all applicable Federal Motor Vehicle Safety and Bumper Standards but it is being imported solely for the purpose of show and display, and I state that I will comply with all applicable restrictions on importers of such vehicles as specified in 49 CFR 561.7. (39 CFR 569).
- D11. The equipment item is subject to the Theft Prevention Standard and is marked in accordance with the requirements of 49 CFR Part 541. (39 CFR 570).
- D12. The vehicle does not conform to all applicable Federal Motor Vehicle Safety, Bumper, and Theft Prevention Standards, but I am eligible to import if because all of the following conditions exist:
- a. I am a member of the armed forces of a foreign country on assignment in the United States,
 - b. I am importing the vehicle on a temporary basis, and for my personal use,
 - c. I will not sell the vehicle to any person in the United States, other than a person eligible to import a vehicle under this paragraph,
 - d. I will export the vehicle upon departing the United States at the conclusion of my tour of duty, and
 - e. I have attached a copy of my official orders. (39 CFR 571)
- D13. The vehicle does not conform to all applicable Federal Motor Vehicle Safety and Bumper Standards, but does conform to applicable Federal Theft Prevention Standards, and I am eligible to import it because I am registered with NHTSA pursuant to 49 CFR Part 562 and such registration is not suspended and has not been revoked, I have imported the vehicle in accordance with that standard, that agency is decided that the vehicle to be imported is eligible for importation, and NHTSA has granted me permission in writing to import the vehicle for that purpose. If the Administrator of NHTSA denies my petition, or decides that the vehicle is not eligible for importation, or if I withdraw my petition, or I fail to present a petition covering the vehicle within 180 days from the date of entry, then I state that I will deliver such vehicle to the Secretary of the Department of Homeland Security for export, or abandon to the United States, within 30 days from the date of the decisional, denial, withdrawal of my petition, or abandonment, or within 210 days from the date of entry if I fail to submit a petition covering the vehicle. If the Administrator of NHTSA grants my petition, then I state that within 180 days from the date that I am notified of that decision, I will furnish a bond, in an amount equal to 150 percent of the estimated value of the vehicle as determined by the Secretary of the Treasury, unless the vehicle is destroyed, to ensure that I will bring the vehicle into conformity with all applicable Federal Motor Vehicle Safety and Bumper standards within 90 days from the date the petition is granted, or will deliver the vehicle to the Secretary of Homeland Security for export, or abandon to the United States. If the vehicle is destroyed, then I state that I will furnish NHTSA with documentary proof of that destruction within 15 days from the date that it occurs.

NAME OF IMPORTER (Please type)	IMPORTER'S ADDRESS (Street, City, State, Zip Code)	
NAME OF DECLARANT (Please type)	DECLARANT'S ADDRESS	
DECLARANT'S CAPACITY	DECLARANT'S SIGNATURE	DATE SIGNED

EPA Requirements: Importers of motor vehicles/engines and nonroad vehicles/engines/equipment must also submit EPA form 3520-1 or 3520-21 to U.S. Customs and Border Protection upon entry into the United States and U.S. territories under the laws administered by the United States Environmental Protection Agency. For more information, please see www.epa.gov/oiaq/imports/index.htm.

NHTSA: Permitting Low Speed Micro Shuttles Con't

NHTSA has a more in-depth process for approving novel technology not commonly found on vehicles in use in the United States.

NHTSA may solicit from the applicant information concerning the vehicle so that the agency can properly assess any potential safety risk the vehicle may pose if it were to be placed in use on public roads or highways in the United States.

In the case of nonconforming vehicles equipped with Automated Driving Systems (ADS), NHTSA commonly requests additional information from the applicant addressing a multitude of issues including:

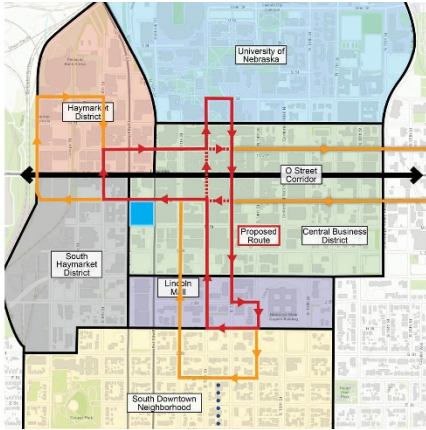
- Speed
- State/Local Authorization
- Power Source
- Automation Level (SAE 1-5)
- Testing Perimeters, Location (Map), Exact Route
- Operator Involvement
- Members of the Public

This process has become stricter and with recent events, NHTSA is willing to pull the plug on demo's

HDR CAV Projects: Lessons Learned

- **Plan & Design**
- **Technology & Infrastructure Needs**
- **Federal, State & Local Regulations**
- **Financing**
- **Insurance & Liability**
- **Stakeholder Engagement**
- **Data, Data, Data**
- **Defining Success**

HDR CAV Projects



Lincoln AV Micro Shuttle Program Implementation



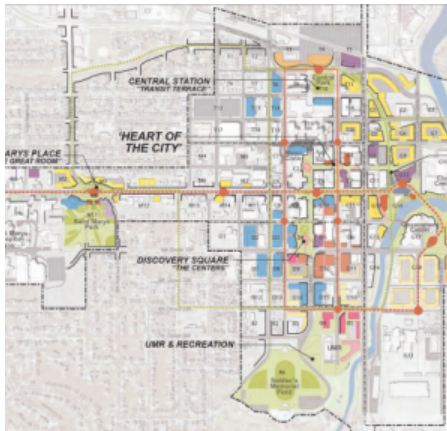
Boise Downtown Circulator AA w/ AV Shuttle Options



Micro On-Demand Shuttle for Arlington



Florida Statewide Transit Technology Primer



Destination Medical Center Transit AA w/ AV Shuttle Option Rochester



Connecticut Statewide AV Micro Shuttle Program



Jacksonville Transportation Authority Shared Mobility



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